EPSON

EPSON TERMINAL PRINTER

FX-80+
FX-100+
FX-85
FX-105

TECHNICAL MANUAL

Y440999100-B

FX-80+/FX-100+
FX-85/FX-185/FX-105

TECHNICAL MANUAL

EPSON

REV.-A

PRECAUTIONS

Precautionary notations throughout the text are categorized relative to 1) personal injury, and 2) damage to equipment:

DANGER Signals a precaution which, if ignored, could result in serious or fatal personal injury. Great caution should be excercised in performing procedures preceded by DANGER heading.

WARNING Signals a precaution which, if ignored, could result in damage to equipment.

The precautionary measures itemized below should always be observed when performing repair/ maintenance procedures.

DANGER

1. ALWAYS DISCONNECT THE PRODUCT FROM BOTH THE POWER SOURCE AND THE HOST COMPUTER BEFORE PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURE.
2. NO WORK SHOULD BE PERFORMED ON THE UNIT BY PERSONS UNFAMILIAR WITH BASIC SAFETY MEASURES AS DICTATED FOR ALL ELECTRONICS TECHNICIANS IN THEIR LINE OF WORK.
3. WHEN PERFORMING TESTING AS DICTATED WITHIN THIS MANUAL, DO NOT CONNECT THE UNIT TO A POWER SOURCE UNTIL INSTRUCTED TO DO SO. WHEN THE POWER SUPPLY CABLE MUST BE CONNECTED, USE EXTREME CAUTION IN WORKING ON POWER SUPPLY AND OTHER ELECTRONIC COMPONENTS.

WARNING

1. REPAIRS ON EPSON PRODUCT SHOULD BE PERFORMED ONLY BY AN EPSON CERTIFIED REPAIR TECHNICIAN.
2. MAKE CERTAIN THAT THE SOURCE VOLTAGE IS THE SAME AS THE RATED VOLTAGE, LISTED ON THE SERIAL NUMBER/RATING PLATE. IF THE EPSON PRODUCT HAS A PRIMARY AC RATING DIFFERENT FROM THE AVAILABLE POWER SOURCE, DO NOT CONNECT IT TO THE POWER SOURCE.
3. ALWAYS VERIFY THAT THE EPSON PRODUCT HAS BEEN DISCONNECTED FROM THE POWER SOURCE BEFORE REMOVING OR REPLACING PRINTED CIRCUIT BOARDS AND/OR INDIVIDUAL CHIPS.
4. IN ORDER TO PROTECT SENSITIVE μp CHIPS AND CIRCUITRY, USE STATIC DISCHARGE EQUIPMENT, SUCH AS ANTI-STATIC WRIST STRAPS, WHEN ACCESSING INTERNAL COMPONENTS.
5. REPLACE MALFUNCTIONING COMPONENTS ONLY WITH THOSE COMPONENTS RECOMMENDED BY THE MANUFACTURER; INTRODUCTION OF SECOND-SOURCE ICs OR OTHER NONAPPROVED COMPONENTS MAY DAMAGE THE PRODUCT AND VOID ANY APPLICABLE EPSON WARRANTY.

PREFACE

This manual discusses operation and repair of two high quality, multi-functional, dot matrix printers: FX-80+/100+ and FX-85/FX-185(105).
Great care has gone into its design and construction. The instructions and procedures included herein are intended to orient the experienced, Epson-certified electronics technician to the function and principles of operation of the product as well as to aid and guide in maintenance and repair techniques.

Chapter 1 – provides a general operational overview as well as product specifications.

Chapter 2 – deals with principles of operation of the printer.

Chapter 3 – discusses the various types of interface options which are compatible for use with the FX-80+/100+ and the FX-85/ FX-185(105).

Chapter 4 – provides a step-by-step procedure for dissassembly, assembly, and adjustment of components.

Chapter 5 – is concerned with troubleshooting techniques.

Chapter 6 – provides insights into proper maintenance techniques and lists tool, lubricants, and adhesives required to properly service the equipment.

With proper care and attention to maintenance suggestions, the printer should give peak performance throughout product life.

* The contents of this manual are subject to change without notice.

REVISION TABLE

REVISION	ISSUED DATE	CHANGE DOCUMENT
A	August 1, 1985	1st issue
B	November 18, 1985	Page 1-3, 2-28, 2-37

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CHAPTER 1
GENERAL DESCRIPTION

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1.1 FEATURES

The FX-80+/FX-100+ and FX-85/FX-185 (105) are multifunctional, impact dot matrix printers capable of producing bidirectional print copy at 160 characters per second.

The FX-80+/FX-100+ printers have the following features:

1. Ten different bit image modes.
2. User definable characters (down-load characters).
3. Proportional printing.
4. Logic seeking.
5. Control panel selectable print modes.
6. A 2K-byte input buffer with an improved throughput capability from the host computer.
7. Optional interface compatibility.
8. Near letter quality printing with an optional word processing unit.
9. Cut sheet feeder options.

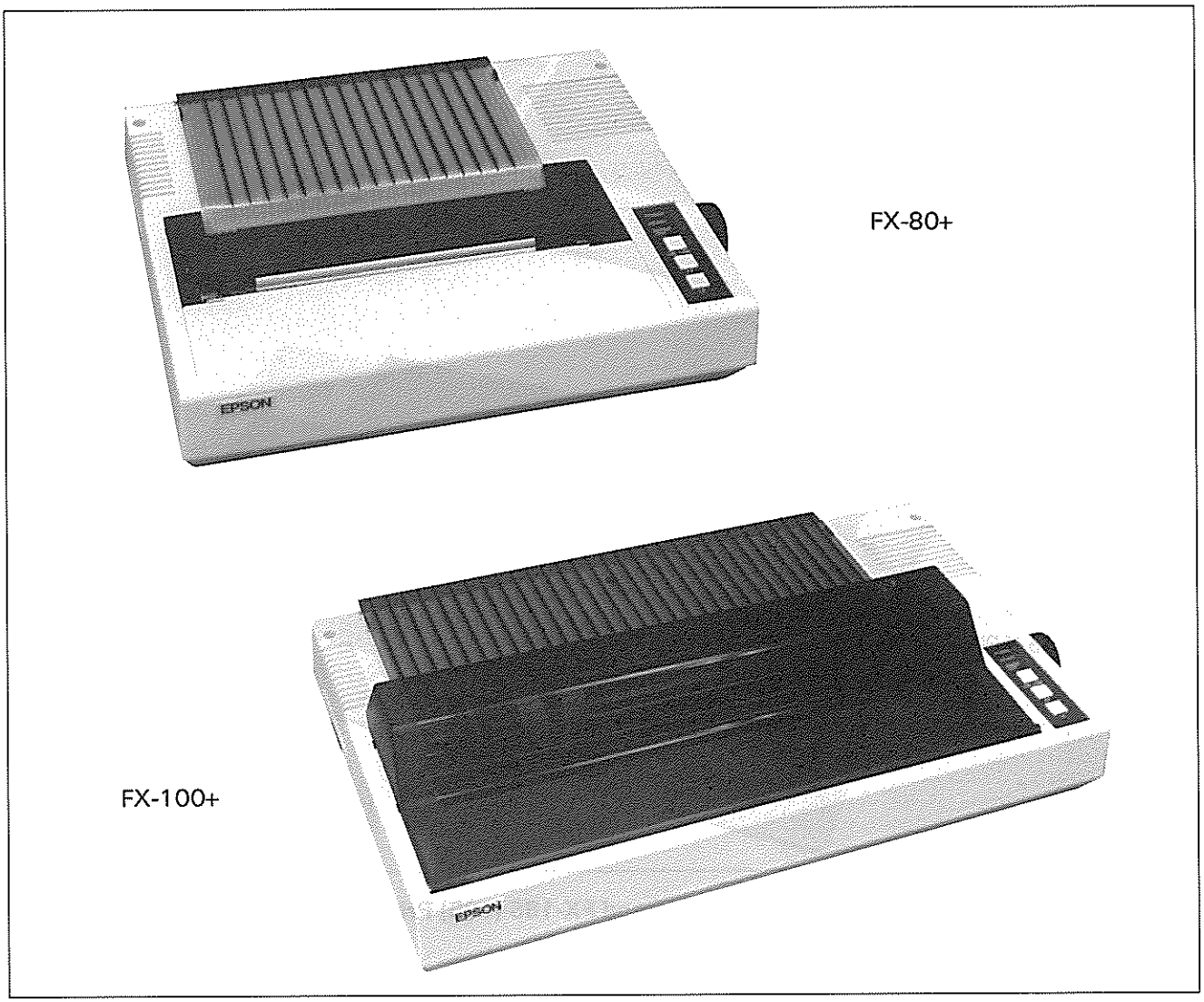

Fig. 1-1. FX-80+ and FX-100+ Printers

REV.-A

The FX-85/FX-185 (105) printers have the following features:

1. Ten different bit image modes.
2. User definable characters (down-load characters).
3. Proportional printing.
4. Logic seeking.
5. Control panel selectable print modes.
6. Fine near letter quality printing.
7. IBM PC printer 5152 emulation.
8. Easy selection of near letter quality and draft modes.
9. An 8K-byte input buffer with an improved throughput capability from the host computer.
10. Up-grading kits for FX and FX+ printer users.

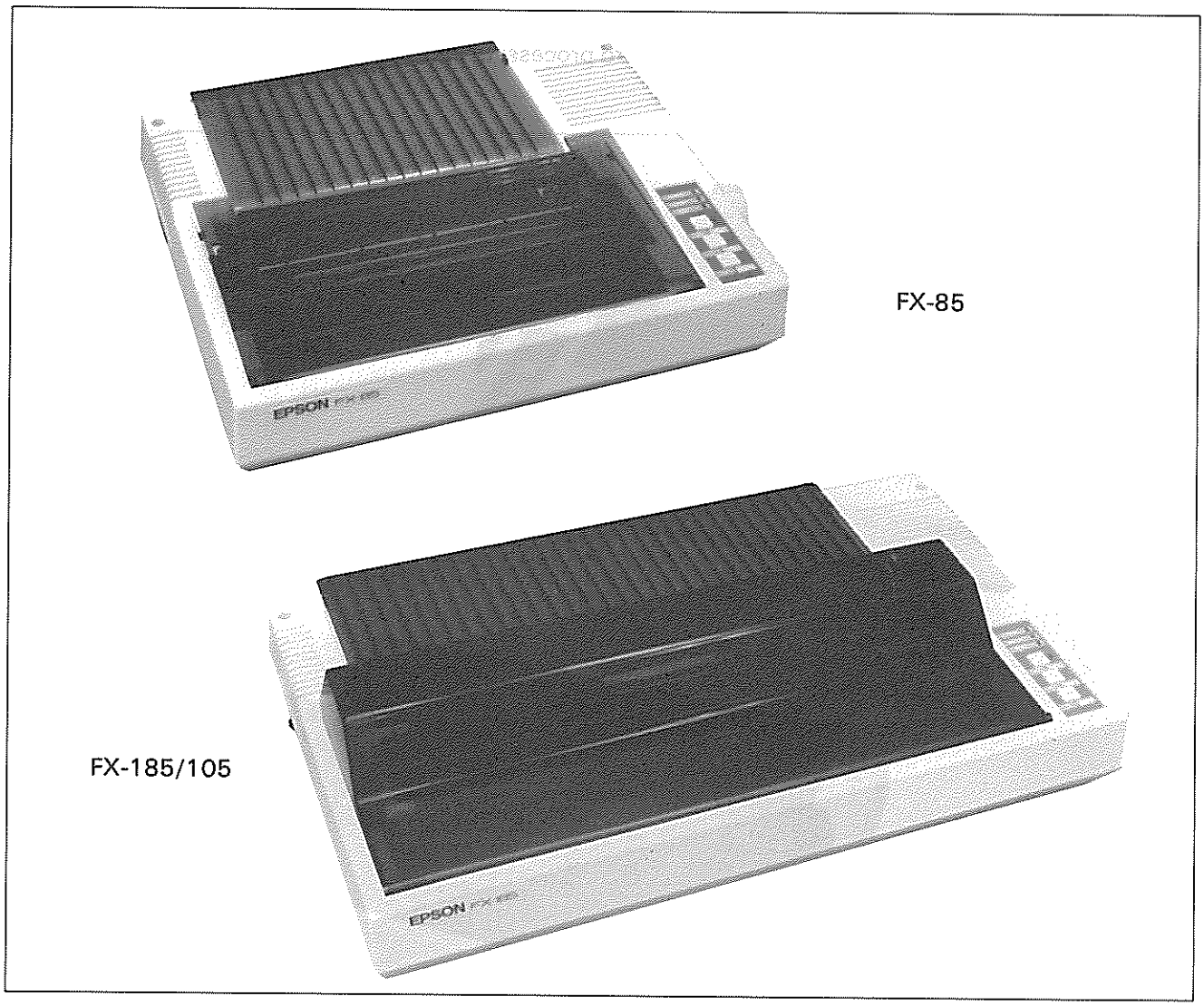

Fig. 1-2. FX-85 and FX-185 (105) Printers

1.2 INTERFACE OVERVIEW

1. Standard Parallel Interface
   The printer comes equipped with the standard parallel interface.
   This standard communication link permits data exchange with many computers without modification or addition of other peripheral devices.
2. RS-232C/Current Loop Serial Interface
   A 20 mA current loop type, serial interface which permits the printer to receive data at a bit rate ranging from 75 to 19200 BPS.
3. IEEE-488 Interface
   An optional interface which permits parallel communication between the printer and any computer or measuring instrument which is equipped with a bus structure conforming to the IEEE-488 Std. 488-1975.

1.3 SPECIFICATIONS

Operation Characteristics

Print Function Parameters

Method..... Impact dot martix

Speed

Normal ..... 160 Characters per second (cps)
Condensed..... 130 Characters per second (cps)
Elite ..... 96 Characters per second (cps)
Emphasized..... 80 Characters pr second (cps)

Print Direction

Normal ..... Bidirectional, logic seeking
Bit Image..... Unidirectional

Typeface Characteristics

Character Configuration..... 9 x 9 matrix (normal letter)
18 x 18 matrix (NLQ)..... FX-85/185/105 only

Character Sets

ASCII ..... 96 Characters
International ..... 32 International (11 countries)
Italic..... 96 Characters (Alternate)

Character Size

Character pitch	Width (mm)	Height (mm)
Pica	2.1	3.1
Elite	1.4	3.1
Condensed	1.05	3.1
Expanded pica	4.2	3.1
Expanded elite	2.8	3.1
Expanded condensed	2.1	3.1
Condensed elite	1.05	3.1
Emphasized	2.1	3.1
Super/subscript	depends on pitch.	1.6

Column Width (maximum characters/line)

Character pitch	FX-80+/85	FX-100+/185/105
Pica	80	136
Elite	96	163
Condensed	132	233
Expanded pica	40	68
Expanded elite	48	81
Expanded condensed	66	116
Condensed elite	160	272
Emphasized	80	136

Paper Feed

Method..... Friction Feed
Adjustable Sprocket Feed
Pin Platen Feed (FX-80+/85 only)

Line Spacing..... 1/6", 1/8" or programmable in increments of 1/72 and 1/216 inch from a host computer.

Line Feed Time..... Approx. 150ms/line (at 1/6")
Approx. 100ms/line (at continuous feed)

Paper Specifications

Type..... Fanfold, Single Sheet
Roll Paper (FX-80+/85 only)

Thickness..... 0.3 mm or less

Copies..... 3, one original and two carbon

Weight..... Single sheet
40-70kg
Multi part form (3 sheets + 2 carbon copies)
34-45kg

Width

Paper	FX-80+/85	FX-100+/185/105
Fanfold Paper	Pin Platen Feed: 228,6mm ~ 254mm (9,5" ~ 10") Adjustable Sprocket Feed: 101,6mm ~ 254mm (4" ~ 9,5")	Adjustable Sprocket Feed: 101,6mm ~ 406,4mm (4" ~ 16")
Single Sheet	Friction Feed: 184mm ~ 216mm (7,25" ~ 8,5")	Friction Feed: 184mm ~ 365,76mm (7,25" ~ 14,4")
Roll Paper	Friction Feed: 216mm (8,5")	none

Environmental Conditions and Reliability

Power Requirements

Input Voltage ..... 120/220/240 VAC ± 10%

Frequency 49.5–60.5Hz

Power Consumption ..... 70 VAmax.

Environmental Conditions

Temperature

Operating ..... 5° to 35°C

Storage ..... –30° to 70°C

Humidity

Operating ..... 10 to 80%

Storage ..... 5 to 85%

Impact Resistance

Operating ..... 1 g (within 1 millisecond)

Storage ..... 2 g (within 1 millisecond)

Vibration Resistance

Operating ..... 0.25G, 55 Hz max.

Storage ..... 0.5G, 55 Hz max.

Insulation Resistance ..... 10M ohms (between AC line and chassis)

Dielectric Strength ..... Shall withstand 1 KVAC (rms) applied between AC line and chassis

Reliability

Printer (excluding printhead) Estimated

Mean-Cycle-Between-Failure ..... 5×10^6 lines

Printhead Estimated Life

Expectancy ..... 100×10^6 characters

Average Ribbon Life Expectancy ..... 3×10^6 characters

Physical Characteristics

	FX-80+	FX-85	FX-100+	FX-185/105
Height (mm)	121	100 (139)*1	123	106 (156)*1
Width (mm)	427	420 (441)*2	602	594 (621)*2
Depth (mm)	354.5	347	363	354
Weight (kg)	7.5	7.8 (8.3)*3	10.5	10.4

NOTE: *1 ..... ( ) data includes the tractor unit.

*2 ..... ( ) data includes the manual paper feed knob.

*3 ..... ( ) data includes the tractor unit.

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Interface

Standard

Data Transfer ..... 8-bit parallel

Synchronization ..... By externally supplied Strobe pulses

Handshake ..... ACKNLG/BUSY signal

Logic Level ..... TTL compatible

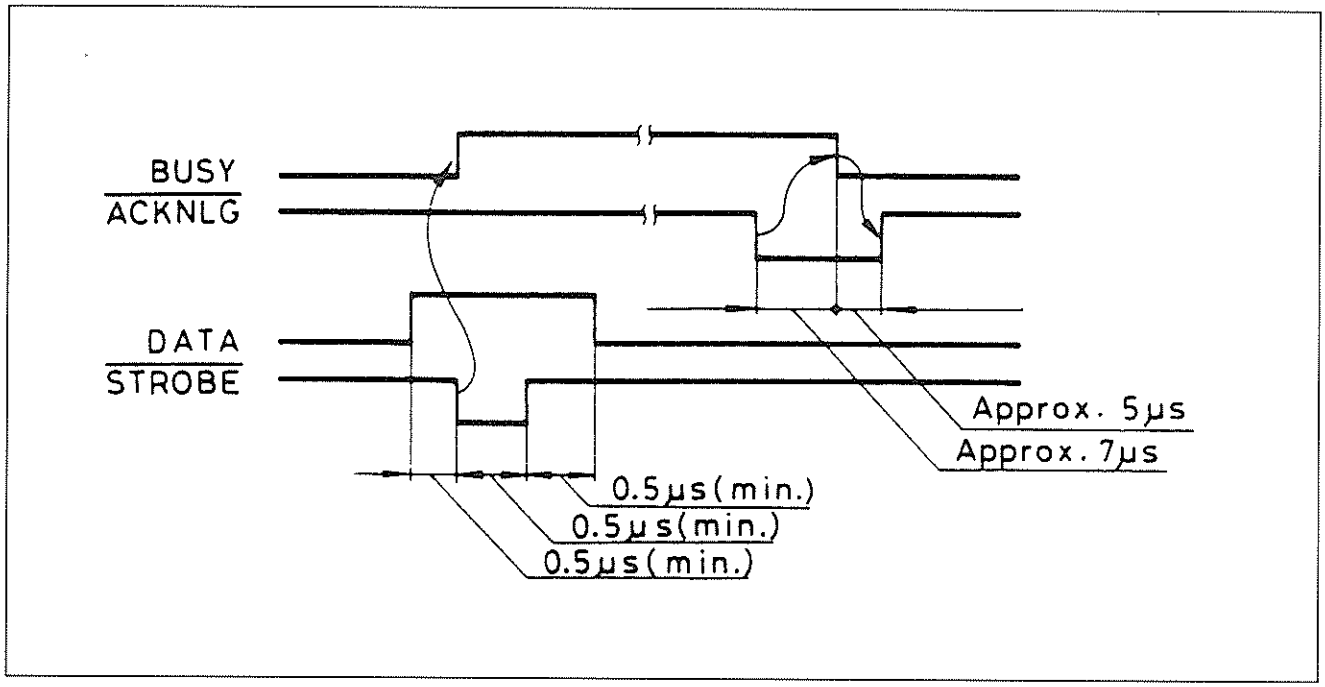


Fig. 1-3. Interface Timing

Safety Approvals

FX-80+/100+ ..... UL 478
CSA 22.2 number 0,154

FX-85/185/105 ..... UL 478, 114
CSA 22.2 number 154
BSI, VDE, TUV

Radio Frequency Interference Approvals

FX-80+/100+ ..... FCC class B
VDE 0806 (IEC 380)

FX-85/185/105 ..... FCC class B
VDE 0871

1.4 MAIN COMPONENTS

This printer is comprised of three major subassemblies housed in a two-piece casing:
The power supply, the main circuit board, and the printer mechanism.

1.4.1 MODEL-3510/3560 PRINTERS MECHANISM (Refer to Figs. 1-4 and 1-5)

The Model-3510/3560 printer mechanism components include the paper feed mechanism, the ribbon feed mechanism, and the carriage assembly. The carriage assembly is comprised of the stepper motor, for carriage feed; two sensors (one to detect when the carriage is in home position and the other for print timing); and the print head.
The paper feed mechanism consists mainly of one stepper motor for paper feed, the friction/ tractor paper feed assembly, and one sensor for out-of-paper detection.
The ribbon feed mechanism is comprised of the ribbon feed assembly.

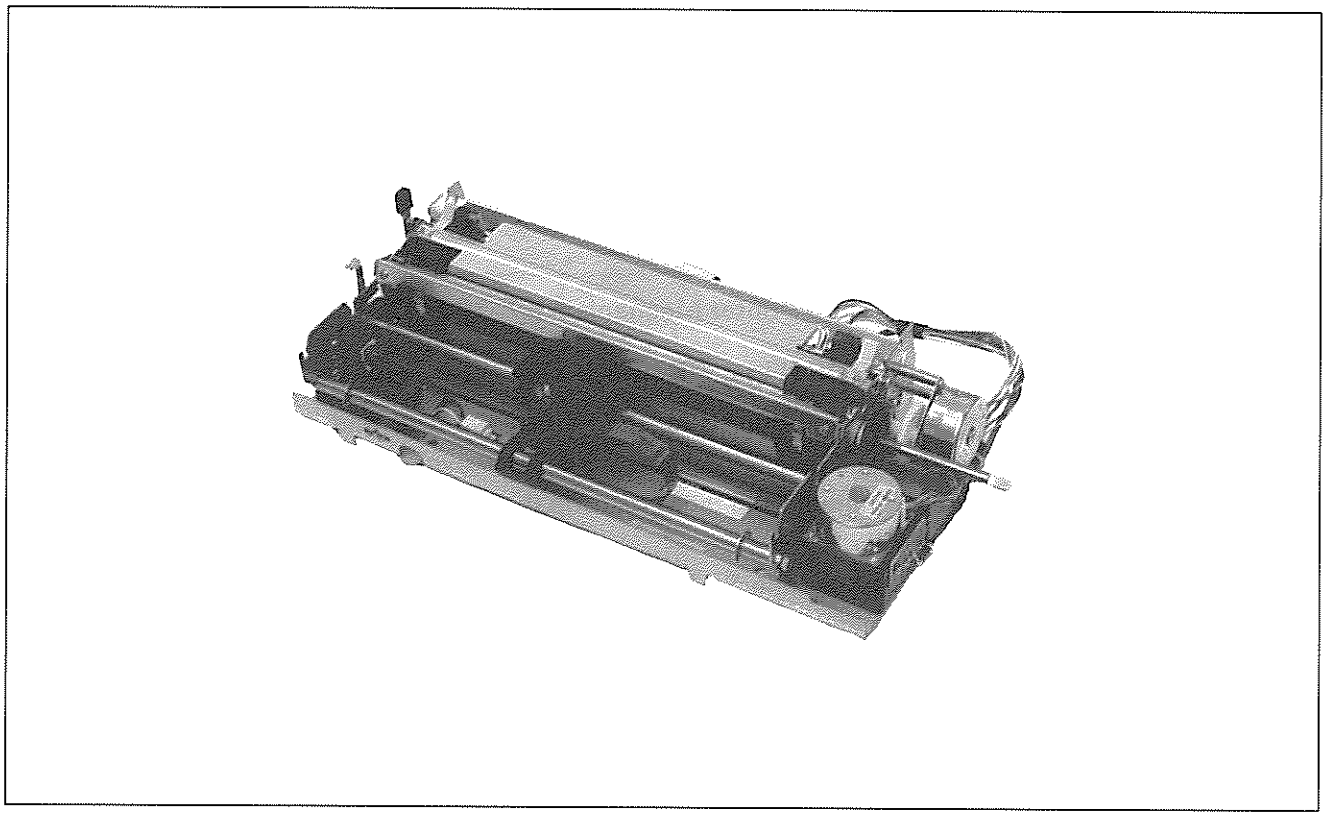


Fig. 1-4. Model-3510 Printer Mechanism (FX-80+/FX-85)

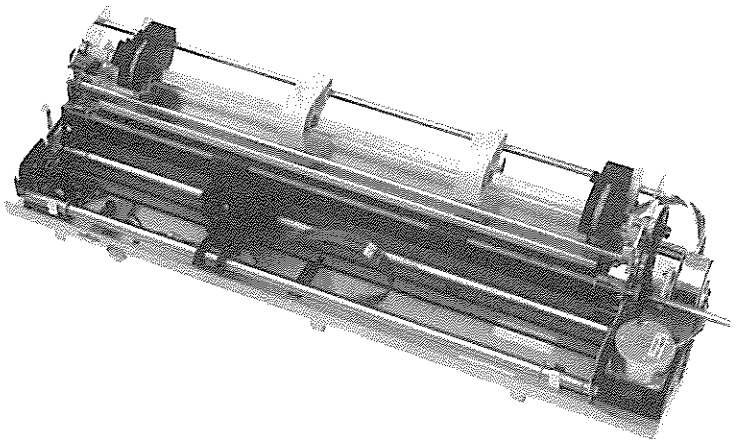


Fig. 1-5. Model-3560 Printer Mechanism (FX-100+/FX-185/105)

1.4.2 CONTROL CIRCUIT BOARDS (Figs. 1-6 and 1-7)

The FXMB circuit board is the main circuit board for the FX-80+/FX-100+ and FX-85/185(105) printers, and controls the printer's electrical and mechanical operations. However, chip configurations of the FXMB found in the FX-80+/FX-100+ are different from those found in the FX-85/FX-185(105) printers.

The FX-80+/FX-100+ printers have only one PC board, the FXMB. This PC board is equipped with two CPUs (master and slave), a 16K-byte ROM, and three 2K-byte RAMs.

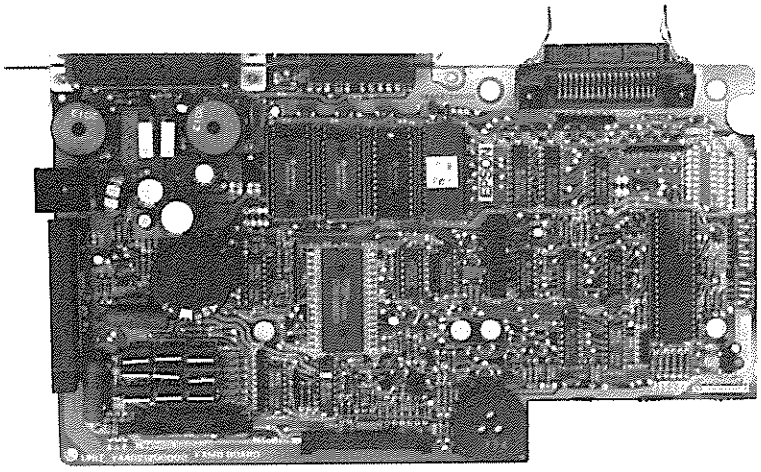


Fig. 1-6. FXMB Circuit Board (FX-80+/100+)

The FX-85/FX-185(105) printers consist of two PC boards—the FXMB and the FXEXT. The FXMB in the FX-85/FX-185(105) printers is equipped with two CPUs (master and slave), two ROMs (16 K bytes and 8 K bytes), and two 2K-byte RAMs. The FXEXT, equipped with a 16K-byte ROM and two 8K-byte RAMs, controls the near letter quality printing.

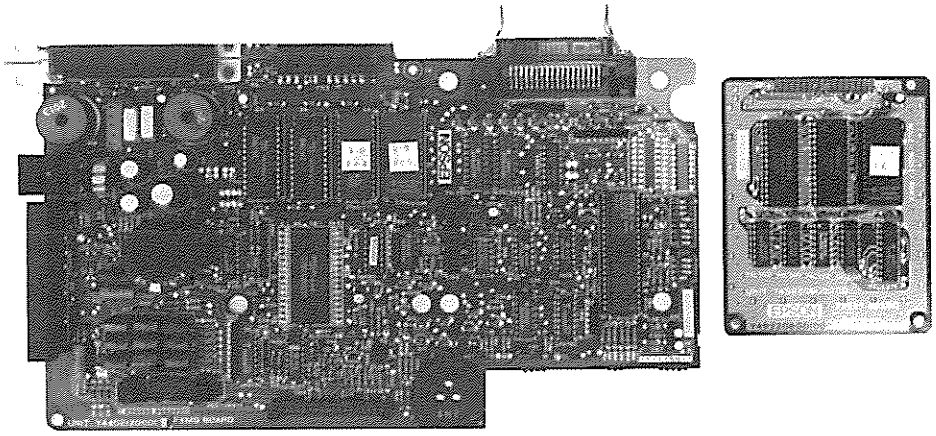
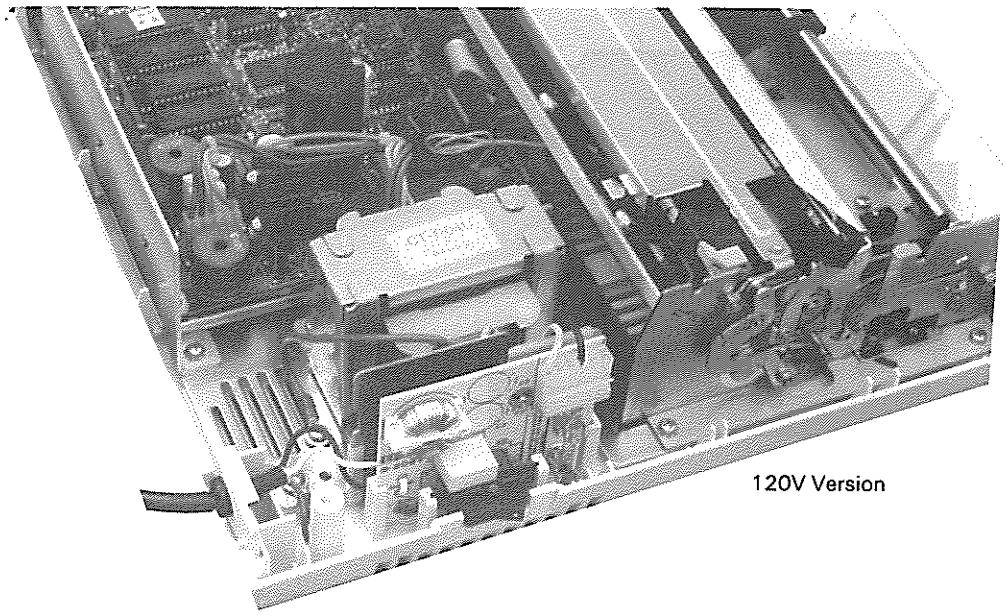


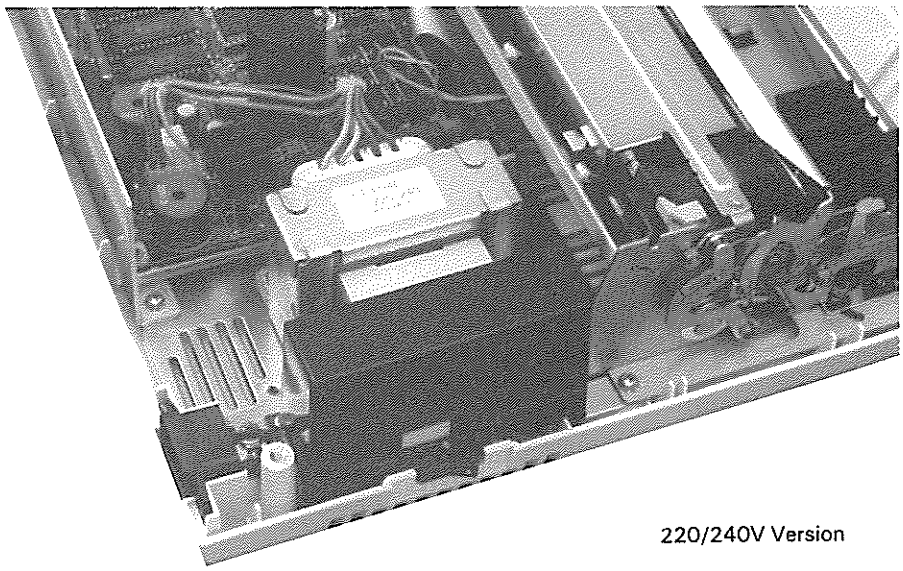
Fig. 1-7. FXMB and FXEXT Circuit Board (FX-85/FX-185/105)

1.4.3 POWER CIRCUIT (Refer to Fig. 1-8.)

The power supply circuit, is comprised of a DC regulator situated on the control circuit board, and a power transformer and line filter, each mounted on the lower case of the Printer. All voltages required for the Printer are supplied via this circuitry.
The line filter prevents noise going from and to the outside line.



120V Version

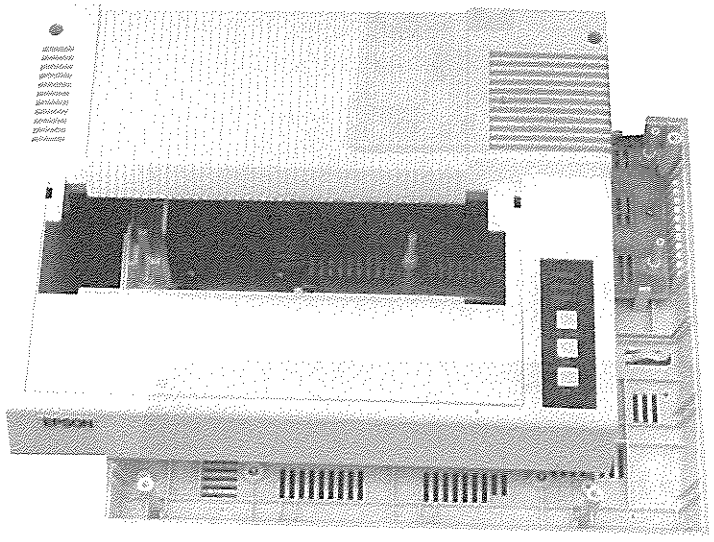


220/240V Version

Fig. 1-8. Power Circuit

1.4.4 HOUSING (Refer to Figs. 1-9 and 1-10)

In the Printer, housing, consisting of the upper and lower cases, accomodates the components shown in Figures 1-9 and 1-10.
Housing is designed to facillitate easy access, removal, and replacement of components.



FX-80+

FX-85+

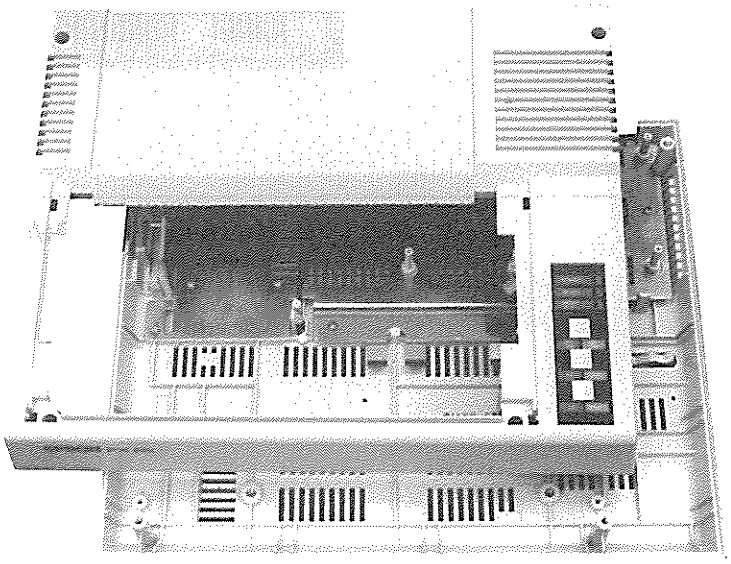
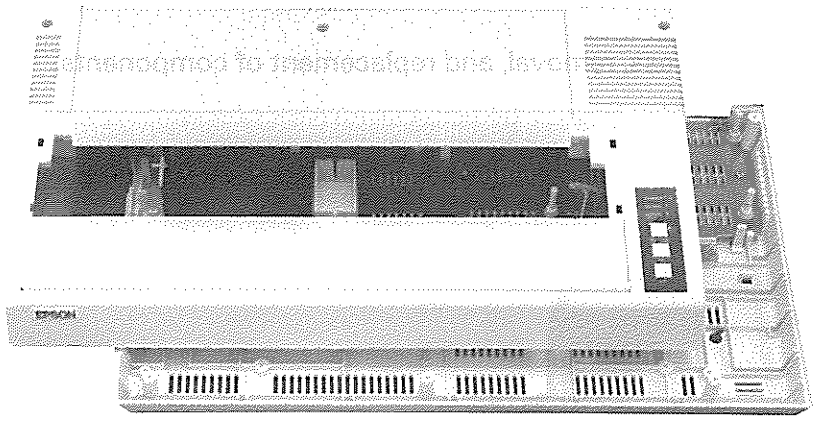
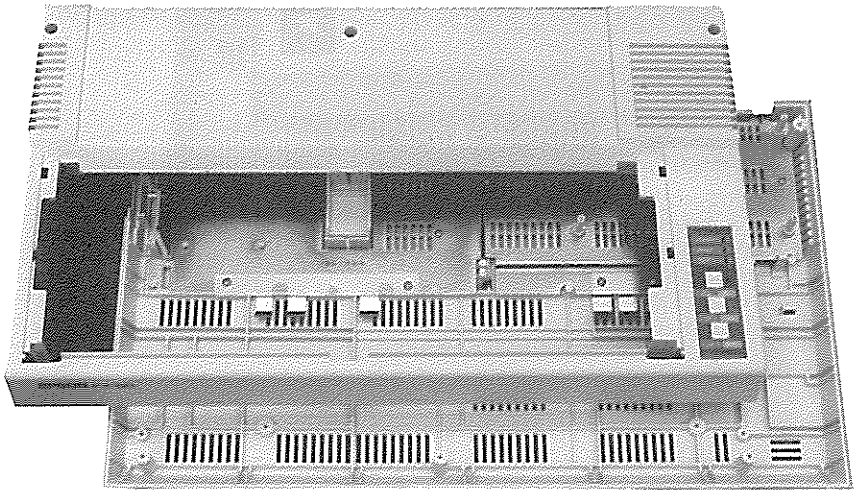


Fig. 1-9. Housing (FX-80+/FX-85)



FX-100+



FX-185/105

Fig. 1-10. Housing (FX-100+/FX-185/105)

CHAPTER 2
OPERATING PRINCIPLES

LIST OF FIGURES

LIST OF TABLES

2.1 DIFFERENCE BETWEEN FX-80+/100+ AND FX-85/185 (105)

Major hardware difference between the FX-80+/100+ and the FX-85/185 (105) is shown in Table 2-1.

Table 2-1. FX-80+/100+ and FX-85/185 (105)

Items	FX-80+/100+	FX-85/185 (105)
Circuit Board	FXMB Board VXOB: Option	FXMB Board FXEXT Board
Main and slave CPU	7810/8042	7810/8042
ROM	16KB ROM	16KB ROM 8KB ROM 16KB ROM (FXEXT)
Fuse ROM	M20214GA	M02016GA
Numbers of RAM	2KB RAM × 3	2KB RAM × 2 8KB RAM × 2 (FXEXT)
Control Panel	FPEL Board	FPEL-SQ Board
Filter Board	FFIL Board	FFIL Board
Printer Mechanism	M-3510/3560	M-3510/3560

2.2 CABLE CONNECTIONS AND SIGNAL FLOW

This section includes signals and pin assignments relating to the various connectors providing electrical connections among printer components such as the printer mechanism, the control circuit board, and the control panel.

Discussion of operating principles of the electrical circuitry and printer mechanism follow pin assignment tables.

See Figure 2-1 for a block diagram demonstrating signal flow through the major printer components. Connector pinouts may be found in Tables 2-1 to 2-8, following.

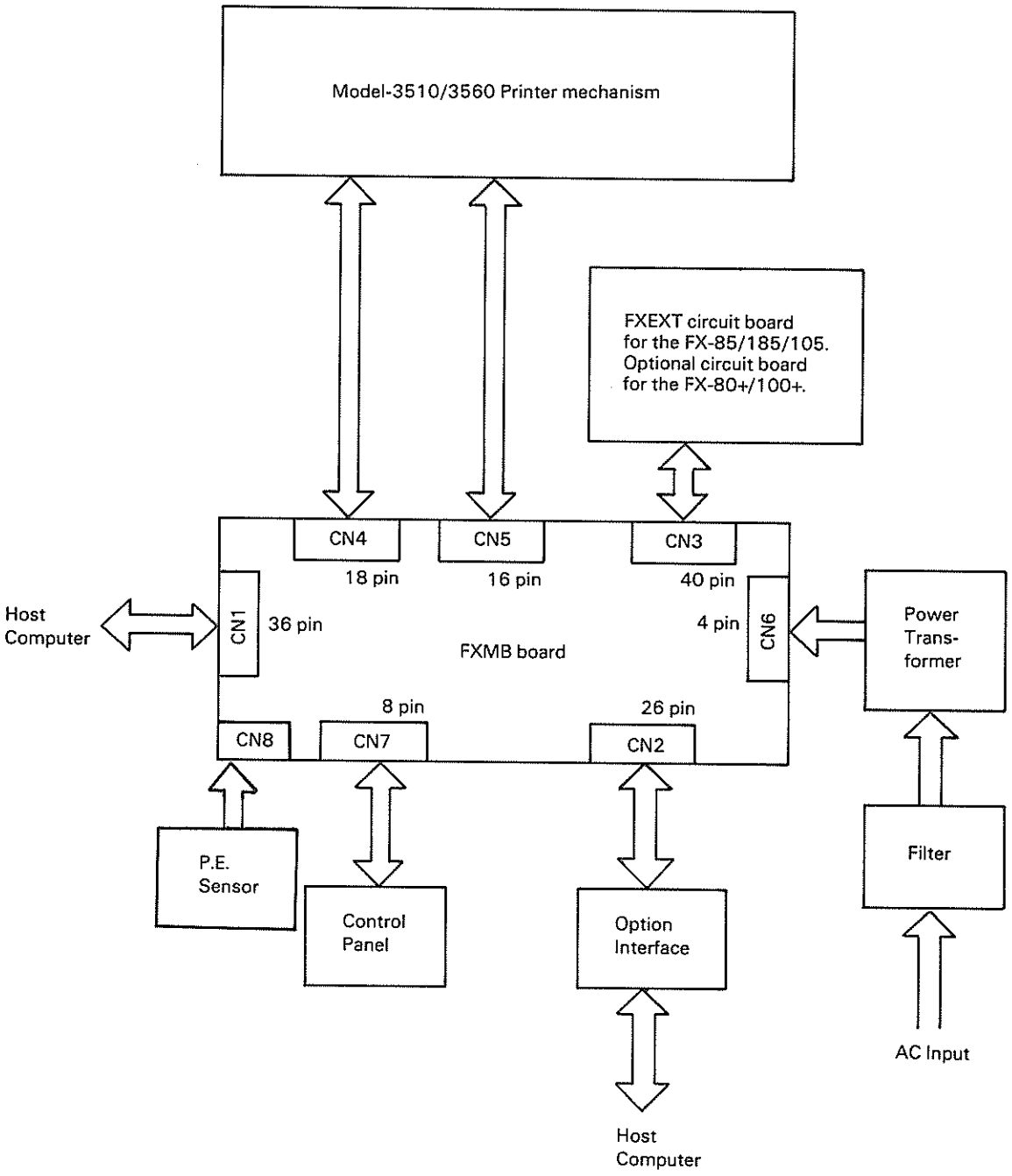


Fig. 2-1. Cable Connections

2.3 ASSIGNMENT OF CONNECTOR PINS

2.3.1 FXMB CIRCUIT BOARD

1. Connector CN1

(a) Use: Data exchange between the host computer and the Printer.
(b) Number of pins: 36 pins
(c) Parts standard: equivalent to 57-30360 (amphenol)
(d) Pin assignment: Refer to Table 2-2.

Table 2-2. Pin Assignment Of CN1

	Signal Pin No.	Return Pin No.	Signal	Transmitter	Description
Parallel Interface With these signals, use twisted-pair cable and connect "Return" to LOGIC GND. Note: The signals which are active at "LOW" are indicated by a bar above.	1	19	$\overline{\text{STROBE}}$	Host Computer	STROBE pulse for read-in of data, pulse width must be more than 0.5 μs at receiving terminal. The signal level is normally HIGH; read-in of data is performed at the LOW level of this signal.
	2 3 4 5 6 7 8 9	20 21 22 23 24 25 26 27	DATA1 2 3 4 5 6 7 8	Host Computer	These signals represent information of the 1st to 8th bits of parallel data respectively. Each signal is at HIGH level when data is logical 1 and LOW when logical 0.
	10	28	$\overline{\text{ACKNLG}}$	Printer	LOW signal indicates that data has been received and that the printer is ready to accept other data. Approx. 12 μs pulse.
	11	29	BUSY		A HIGH signal indicates that the printer cannot receive data. A LOW signal indicates that the printer can receive data. The signal becomes HIGH in the following cases: 1. During data entry 2. During printing operation and part of head carrier operation 3. During part of paper feed 4. During printer error status 5. In OFF-LINE state
	12	30	PE	Printer	A HIGH signal indicates that the printer is out of paper.
	13		SLCT	Printer	Pulled up to +5V through 3.3 kΩ resistance

	Signal Pin No.	Return Pin No.	Signal	Transmitter	Description
	14		$\overline{\text{AUTO}}$ $\overline{\text{FEEDXT}}$	Host Computer	With this signal being at LOW level the paper is automatically fed one line after printing.
	15		NC		Not used.
	16		GND		LOGIC GND level.
	17		FG		Printer FRAME GND.
	18		NC		Not used.
	19 ~ 30		GND		TWISTED-PAIR RETURN signal GND level.
	31		$\overline{\text{INIT}}$	Host Computer	When the level of this signal becomes LOW, the print buffer memory is cleared. The pulse width must be more than 50 μs at the receiving terminal.
	32		$\overline{\text{ERROR}}$	Printer	The level of this signal becomes LOW. When the printer is in the error status: 1. PAPER END state (cancelled by ESC8) 2. Abnormal motor operation 3. OFF-LINE state
	33		GND		Twisted pair return level at ground.
	34		NC		Not used.
	35		+5V	Printer	Pulled up to +5V through 3.3 kΩ resistance
	36		$\overline{\text{SLCTIN}}$	Host Computer	With this signal being at LOW level, the printer is selected.

NOTES:

1. "Return" denotes "TWISTED PAIR RETURN" and is to be connected at signal ground level.
2. All interface conditions are based on TTL level. Both the rise and fall times of each signal must be less than 0.2μs.
3. Data transfer must not be carried out by ignoring the $\overline{\text{ACKNLG}}$ or BUSY signal. When data transfer is made in an $\overline{\text{ERROR}}$ state, the printing and processing of the data is not guaranteed.

2. Connector CN2

(a) Use: Data exchange between the optional interface board and the control circuit board.

(b) Number of pins: 26 pins

(c) Pin assignment: Refer to Table 2-3.

Table 2-3. Pin Assignment of CN2

Pin No.	Signal Name	Direction	Description of Signal
1	$\overline{ERR}$	Out	Error
2	PE	Out	Paper End
3	D7	In	Data Bit 7
4	$\overline{RDY}$ (BUSY)	Out	Ready
5	D6	In	Data Bit 6
6	ACK	Out	Acknowledge
7	D5/PAR DIS	In	Data Bit 5/Parity Disable
8	$\overline{INIT}$	In	Initial
9	D4/O/E	In	Data Bit 4/Odd Parity Select/Even Parity Select
10	$\overline{STB}$	In	Strobe
11	D8/SI	In	Data Bit 8/Serial Signal Input
12	AC12	Out	+12V AC
13	$\overline{R}$	Out	Reset
14	AC12	Out	+12V
15	D3/B2	In	Data Bit 3/Bit Rate Select
16	+5	Out	+5V DC
17	D2/B1	In	Data Bit 2/Bit Rate Select
18	+24	Out	+24V DC
19	D1/8/7	In	Data Bit 1/8 Bit Select/7 Bit Select
20	+12	Out	+12V DC
21	P/S	In	Parallel Select/Serial Select
22	—	—	—
23	$\overline{SELIN}$	In	Select In
24	QL	—	Ground
25	TXD $\overline{PET}$/TRS	In	Serial Signal Output ($\overline{PET}$/TRS Select)
26	GL	—	Ground

NOTE:

"Direction" refers to the direction of signal flow as viewed from the control circuit board.

3. Connector CN3

(a) Use: FXEXT circuit board connector for the FX-85/185/105 or option board connector for the FX-80+/100+

(b) Number of pins: 32 pins

(c) Pin assignment: Refer to Table 2-4.

Table 2-4. Pin Assignment of CN3

Pin No.	Signal Name	Direction	Description of Signal
1	A0	Out	Address Bit 0
2	A2	Out	Address Bit 2
3	A4	Out	Address Bit 4
4	A6	Out	Address Bit 6
5	A8	Out	Address Bit 8
6	A10	Out	Address Bit 10
7	A12	Out	Address Bit 12
8	CS6	Out	Chip Select 6
9	D0	In/Out	Data Bit 0
10	D2	In/Out	Data Bit 2
11	D4	In/Out	Data Bit 4
12	D6	In/Out	Data Bit 6
13	$\overline{RD}$	Out	Read Out Signal
14	$\overline{RST}$	Out	Reset Signal
15	+24	Out	+24V DC
16	+5	Out	+5V DC
17	A1	Out	Address Bit 1
18	A3	Out	Address Bit 3
19	A5	Out	Address Bit 5
20	A7	Out	Address Bit 7
21	A9	Out	Address Bit 9
22	A11	Out	Address Bit 11
23	A13	Out	Address Bit 13
24	CS7	Out	Chip Select 7
25	D1	In/Out	Data Bit 1
26	D3	In/Out	Data Bit 3
27	D5	In/Out	Data Bit 5
28	D7	In/Out	Data Bit 7
29	$\overline{WR}$	Out	Write In Signal
30	GP	—	
31	GL	—	Logic Ground
32	GL	—	Logic Ground

NOTE: "Direction" refers to the direction of signal flow as viewed from the control circuit board.

1. Connector CN4

(a) Use: Exchange of control signals between the control circuit board and the carriage motor, paper feed motor and PTS sensor of the Printer mechanism.

(b) Number of pins: 18 pins

(c) Pin assignment: Refer to Table 2-5.

Table 2-5. Pin Assignment of CN4

Pin No.	Signal Name	Direction	Description of Signal
1	CRA	Out	Carriage Motor A Phase
2	CRB	Out	Carriage Motor B Phase
3	CMAB	Out	Carriage Motor A & B Phase Common Line
4	CRC	Out	Carriage Motor C Phase
5	CRD	Out	Carriage Motor D Phase
6	CMCD	Out	Carriage Motor C & D Phase Common Line
7	PFA	Out	Paper Feed Motor A Phase
8	PFB	Out	Paper Feed Motor B Phase
9	PFC	Out	Paper Feed Motor C Phase
10	PFD	Out	Paper FEED Motor D Phase
11	PFCM	Out	Paper Feed Motor Common Line
12	PFCM	Out	Paper Feed Motor Common Line
13	—	—	Not used
14	+5	Out	PTS Sensor Power +5V DC
15	LED +	Out	PTS Sensor LED Power
16	MTS	In	PTS Sensor Timing Signal
17	GP	—	PTS Sensor GND
18	GP	—	PTS Sensor Shield

NOTE:

"Direction" refers to the direction of signal flow as viewed from the control circuit board.

5. Connector CN5

(a) Use: Exchange of control signals between the control circuit board and the print head and HOME (HP) sensor of the Printer mechanism.

(b) Number of pins: 16 pins

(c) Pin assignment: Refer to Table 2-6.

Table 2-6. Pin Assignment of CN5

Pin No.	Signal Name	Direction	Description of Signal
1	GND	—	HOME (HP) Sensor GND
2	HOME	In	HOME (HP) Sensor R Signal
3	GND	—	HOME (HP) Sensor GND
4	RLED	Out	HP Sensor LED Power
5	HD2	Out	Print Solenoid #2 Drive Signal
6	HD3	Out	Print Solenoid #3 Drive Signal
7	HD6	Out	Print Solenoid #6 Drive Signal
8	HD7	Out	Print Solenoid #7 Drive Signal
9	HD8	Out	Print Solenoid #8 Drive Signal
10	HD1	Out	Print Solenoid #1 Drive Signal
11	HD4	Out	Print Solenoid #4 Drive Signal
12	HD5	Out	Print Solenoid #5 Drive Signal
13	HD9	Out	Print Solenoid #9 Drive Signal
14	+24	Out	Print Solenoid Common Line (+24V Power)
15	+24	Out	Print Solenoid Common Line(+24V Power)
16	+24	Out	Print Solenoid Common Line (+24V Power)

NOTE:
"Direction" refers to the direction of signal flow as viewed from the control circuit board.

6. Connector CN6

(a) Use: Supply voltage from the power transformer to the control circuit board.

(b) Number of pins: 4 pins

(c) Pin assignment: Refer to Table 2-7.

Table 2-7. Pin Assignment of CN6

Pin No.	Signal Name	Lead Color	Use
1	AC1	Orange	26V AC for logic circuit, stepper motor and head solenoid
2	AC2	Orange	
3	AC3	Gray	12V AC for option interface
4	AC4	Gray	

7. Connector CN7

(a) Use: Signal exchange between the control panel and the control circuit board.

(b) Number of pins: 8 pins

(c) Pin assignment: Refer to Table 2-8.

Table 2-8. Pin Assignment of CN7

Pin No.	Signal Name	Direction	Description of Signal
1	+5	Out	LED Lamp Drive Power
2	RDY LP	Out	READY LED Drive Signal
3	PELP	Out	Paper End LED Drive Signal
4	ON LINE LP	Out	ON LINE LED Drive Signal
5	LF SW	In	LINE FEED Signal
6	FF SW	In	FORM FEED Signal
7	ON LINE SW	In	ON/OFF LINE Switching Signal
8	GL	—	Logic Ground

NOTE:
"Direction" refers to the direction of signal flow as viewed from the control circuit board.

8. Connector CN8

(a) Use: Send signal from the PE sensor on M-3510/3560 to the control circuit board.

(b) Number of pins: 2 pins

(c) Pin assignment: Refer to Table 2-9.

Table 2-9. Pin Assignment of CN8

Pin No.	Signal Name	Direction	Use
1	PE+	In	Paper End Sensor +Side
2	PE–	—	Paper End Sensor –Side (Logic Ground)

NOTE:
"Direction" refers to the direction of signal flow as viewed from the control circuit board.

2.4 APPLICATIONS AND MAIN FUNCTIONS OF THE PC BOARDS

The FXMB PC board is used for the FX-80+/FX-100+ and the FX-85/FX-185 (105) printers. However, the functions of the ROM and RAMs of the FXMB in the FX-80+/FX-100+ are different from those in the FX-85/FX-185 (105) printers. Furthermore, the FX-85/FX-185 (105) printers have the FXEXT board that allows near letter quality printing. Figure 2-2 shows a block diagram of the FXMB in the FX-80+/FX-100+ printers; Figure 2-3 shows a block diagram of the FXMB in the FX-85/FX-185 (105) printers.

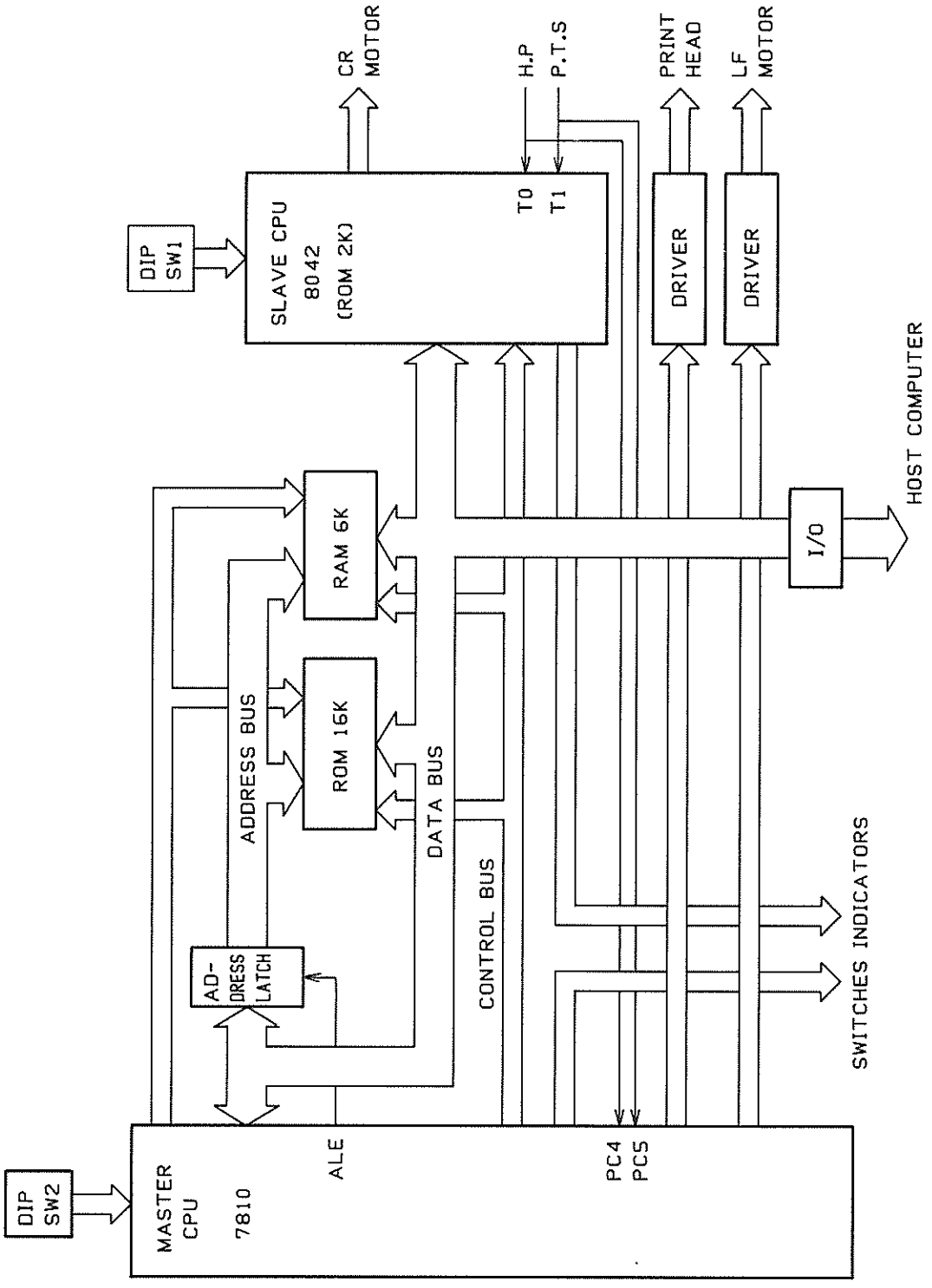


Fig. 2-2. FXMB Block Diagram (for the FX-80+/100+)

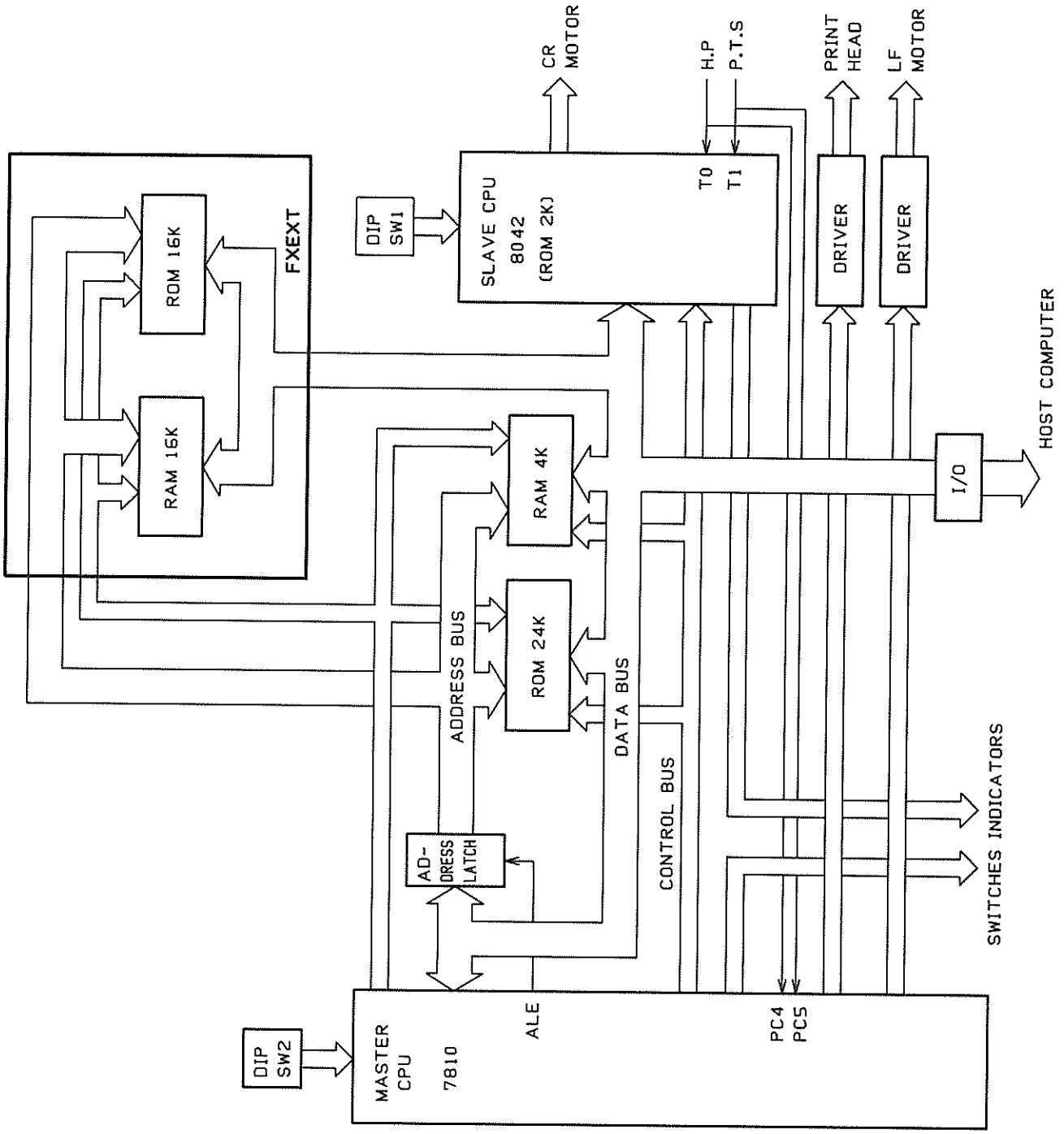


Fig. 2-3. FXMB (with FXEXT) Block Diagram (for the FX-85/185/105)

2.4.1 FUNCTIONS OF THE FXMB/FXEXT CIRCUIT BOARD

This section separately describes functions of the main components (two CPUs and other ICs) of the FXMB in the FX-80+/100+ and in the FX-85/185(105) printers. And this section also describes functions of the main components of the FXEXT in the FX-85/185(105).

2.4.1.1 FXMB Components and Functions (FX-80+/FX-100+)

The FXMB in the FX-80+/FX-100+ printers has two CPUs — master CPU (μPD 7810G) and slave CPU (8042).

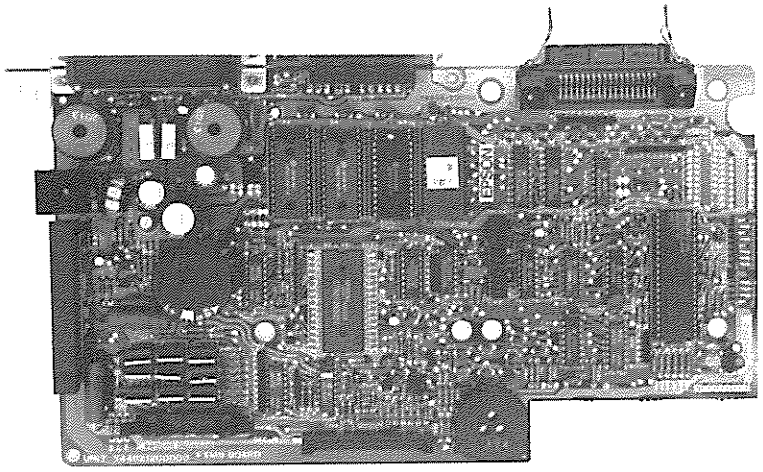


Fig. 2-4. FXMB Circuit Board (FX-80+/100+)

Master CPU (μ7810G)

The master CPU is controlled by the program stored in the 16K-byte ROM of the IC 5A. The main functions of the master CPU are as follows:

1) The master CPU provides a handshake with the host computer for parallel or serial data transfer and receives the data sent from the host computer in the buffer. If the transferred data are the data to be printed out, they are stored in an external RAM print buffer; if the data are control data, the data set the associated parameters and modes.
2) The master CPU instructs an external RAM to stored down-load instructions in the RAM's down-load buffer.
3) When the print instruction is issued from the host computer, the master CPU instructs the slave CPU (8042) to initiate the carriage motion and instructs the drive circuit to operate according to the print timing of the PTS signal. At the same time, the master CPU outputs the data stored in the print buffer or in the down-load buffer from ports A and B (based on the preset parameter and mode) to the print drive circuit.
4) Based on the preset parameter and mode, the master CPU emits a signal from port C to the paper feed drive circuit, defining both the amount of paper to be fed and paper feeding direction.
5) The master CPU detects a short-circuit, an abnormally high voltage in a driver transistor, or an erroneous signal from the slave CPU. The master CPU also emits a signal to cut off +24V power for circuit protection.

Slave CPU (8042)

The slave CPU is controlled by the program in its internal 2K-byte ROM. The main functions of the 8042 are as follows:

1) The slave CPU receives an instruction from the master CPU to activate the carriage motor, and controls the carriage speed.
2) When the power is on, the slave CPU seeks the carriage home position. From this time on, the slave CPU recognizes the carriage position.
3) When an error occurs, the slave CPU activates the buzzer alarm.

The FXMB in the FX-80+/FX-100+ printers also has a 16K-bytes ROM (IC 5A, 27128/23128) as firmware to control the logic circuit and three 2K-byte RAMs (ICs 2A, 3A, and 4A) to store the data sent from the host computer or to store down-load characters. The FXMB also includes IC 4B (M20214GA), IC 1 (STK7563F), and IC 2 (STK6982).

IC 5A (16K-byte ROM)

IC 5A (27128/23128) is a 16K-byte ROM that stores all the programs for operating the FX-80+/FX-100+ printers. The ROM also includes a character generator that controls international characters of 11 countries, ASCII characters, and Italic characters.

ICs 2A, 3A, and 4A (3 × 2K-byte RAMs)

The FXMB in the FX-80+/FX-100+ printers has three 2K-byte RAMs (μPD4016D). The functions of the μPD4016D are as follows:

- To store the data sent from the host computer in the input buffer.
- To store in its down-load buffer the down-load characters defined by the user.
- To provide a working area for different kinds of control codes.

IC 4B (M20214GA)

IC 4B is called "Fuse ROM" and has a 256-bit ROM capacity. When the master CPU inputs the address data in the fuse ROM, one of the eight output signals goes low to select one chip from among the RAMs, the ROM, and the slave CPU.

IC 1 (STK7563F)

IC 1 is a DC regulator which outputs +24 V and +5 V. (Refer to Section 2.6.1.3 for details.)

IC 2 (STK6982)

IC 2 is a carriage drive IC, and is controlled by the slave CPU. (Refer to Section 2.6.4 for details.)

2.4.1.2 FXMB Components and Functions (FX-85/FX-185/105)

The FXMB in the FX-85/FX-185(105) has two CPUs—master CPU (μPD7810G) and slave CPU (8042). The functions of the μPD7810G and the 8042 are exactly the same as those of the FX-80+/FX-100+ printers. Therefore, the electric circuitry in the FX-85/FX-185(105) is the same as in the FX+ series. (Refer to Section 2.4.1.1 for details about the CPU functions.)

However, there are four main differences between the FXMB found in the FX-85/FX-185(105) and the FXMB found in the FX+ series. They are:

1) The FX-85/FX-185(105) have two ROMs (16K bytes and 8K bytes), while the FX+ series has only one (16K bytes) ROM.
2) The FX-85/FX-185(105) have two RAMs (2 x 2K bytes), while the FX+ series has three RAMs (3 x 2K bytes).
3) IC 4B (fuse ROM) in the FX-85/FX-185(105) is the M02016GA, while the fuse ROM in the FX+ series is the M20214GA.
4) The jumper plug settings are different. (Refer to Section 2.4.3 for details.)

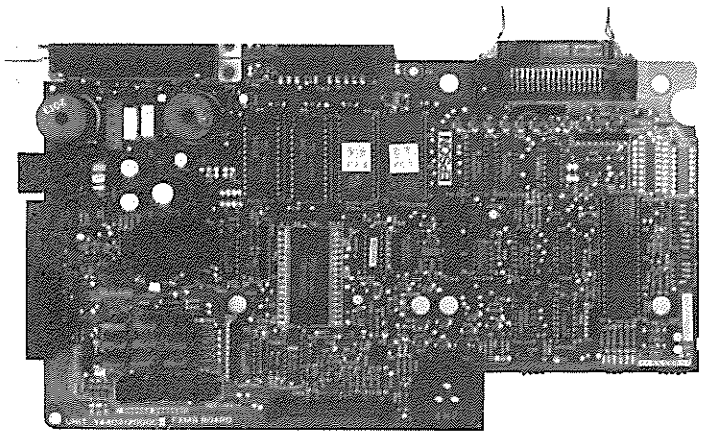


Fig. 2-5. FXMB Circuit Board (FX-85/FX-185/105)

The ICs on the FXMB in the FX-85/FX-185(105) are as follows:

Master CPU (μPD7810G)

The master CPU in the FX-85/FX-185(105) printers is controlled by the program stored in the 16K-byte ROM in IC 5A. (Refer to Section 2.4.1.1 for details about CPU functions.)

Slave CPU (8042)

The slave CPU has the same functions as those for the slave CPU in the FX+ series. (Refer to Section 2.4.1.1 for details.)

IC 5A (16K-byte ROM)

The 16K-byte ROM stores the main programs for operating the FX-85/FX-185(105) printers.

IC 4A (8K-byte ROM)

IC 4A is a character generator ROM for characters in the draft mode.

ICs 2A and 3A (2 x 2K-byte RAMs)

One RAM is used to stored the data sent from the host computer in the input buffer. The other RAM is used to stored the down-load characters in the down-load buffer (1 K byte) and to provide a working area (1 K byte) for the control codes.

IC 4B (M02016GA)

IC 4B is called a fuse ROM, and has a 256-bit memory capacity. When the master CPU sends the address data to IC 4B, one of the eight output signals goes low to select one chip from among the ROMs, the RAMs, and the slave CPU.

IC 1 (STK7563F)

IC 1 is a D.C. regulator and outputs +24V and +5V. (Refer to Section 2.6.1.3 for details.)

2.4.1.3 FXEXT Components and Functions (FX-85/FX-185/105)

The FXEXT in the FX-85/FX-185(105) has a ROM (16 K bytes) and two RAMs (2 x 8K-bytes). The main functions of each components are as follows:

IC 5A (16K-byte ROM)

IC5A (27128/23128) is a 16K-byte ROM that stores the NLQ image data (i.e. NLQ character generator).

ICs 1A and 3A (2 x 8K-byte RAMs)

IC 1A is used for print-column justification and is used to store the NLQ image data.
IC 3A is input buffer, and all send data from the host computer are stored in this buffer.

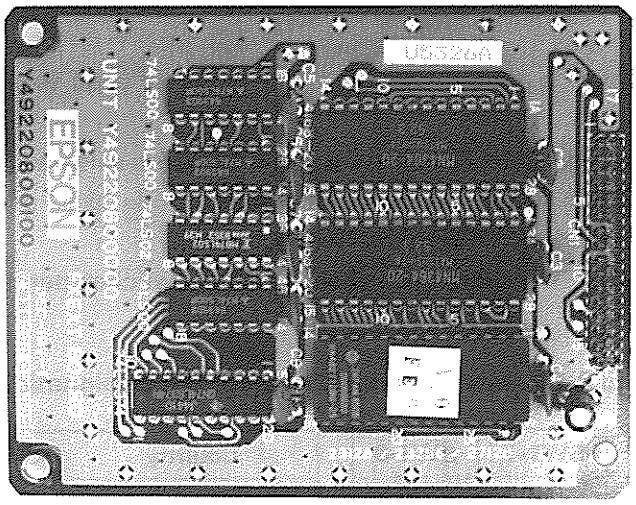


Fig. 2-6. FXEXT Circuit Board (FX-85/FX-185/105)

2.4.2 DIP SWITCH SETTINGS

(1) Setting of DIP Switch No. 1 (Table 2-10)

The DIP switch No. 1 includes the following 8 positions. A summary of the functions of the respective DIP switch positions and their preset conditions at the time of shipment are shown in Table 2-10.

Table 2-10. Functions of Conditions of DIP Switch No. 1

SW	Function	OFF	ON	Factory-Set Condition
1-1	Typeface	Pica	Condensed	OFF
1-2	ZERO font	0	Ø	OFF
1-3	Paper-end detector	Valid	Invalid	OFF
1-4	Input buffer (FX-80+/100+) User-defind	Character	User RAM area	ON
	Character mode (FX-85/185/105)	IBM	ESC/P	
1-5	Print mode at POWER ON	Normal	Emphasized	OFF
1-6	International character set	See Table 2-11		–
1-7	International character set			–
1-8	International character set			–

1) *SW1-2:* Setting this position to ON will cause character "Ø" (zero with slash) to be printed.
2) *SW1-3:* This position is used to activate or deactivate the paper-end detector. When this position is turned ON, the paper end detection function becomes invalid upon power application and the printer is allowed to operate even if it is out of paper.
   With the printer in this state, input of control code "ESC 9" will permit the paper end detector to be activated again.
3) *SW1-4:* When this position is turned ON, the input buffer is used to speed up data processing. (FX-80+/100+).
   When this position is turned ON, the ESC/P control code mode is selected. (FX-85/185/105).
4) *SW1-5:* Setting this position to ON will cause the printer mode to be set to the Emphasized mode upon power application; setting to OFF, to the Normal mode.
5) *SW1-6, SW1-7, and SW1-8:* Combined use of these three switches permits selection of an international character set.

Table 2-11. International Character Set Designation

Country	SW1-6	SW1-7	SW1-8
U.S.A	ON	ON	ON
FRANCE	ON	ON	OFF
GERMANY	ON	OFF	ON
ENGLAND	ON	OFF	OFF

Country	SW1-6	SW1-7	SW1-8
DENMARK	OFF	ON	ON
SWEDEN	OFF	ON	OFF
ITALY	OFF	OFF	ON
SPAIN	OFF	OFF	OFF

The above settings can be changed to any country character sets by inputting ESC R control codes.

(2) Setting of DIP Switch No. 2 (Table 2-12)

The DIP switch No. 2 includes the following 4 positions. A summary of the functions of the respective DIP switch positions and their preset conditions at the time of shipment are shown in Table 2-12.

Table 2-12. Function and Conditions of DIP Switch No. 2

SW No.	Function	OFF	ON	Factory-Set Condition
2-1	$\overline{\text{SLCT IN}}$ signal internally fixed or not fixed	Not fixed	Fixed	ON
2-2	Cut Sheet Feeder (option)	Invalid	Valid	OFF
2-3	1 inch skip-over perforation	Invalid	Valid	OFF
2-4	Automatic line feed	LF must be sent from host	Auto LF with CR	OFF

1) *SW2-1:* When the position is ON, printer is permanently in the "selected" mode and no external software codes.
   This setting affects pin 36 on the connector. Some computers control this pin; if they do control the pin, the switch setting should always be OFF.
2) *SW2-2:* Is set this switch to ON only when installing the optional cut sheet feeder; leave it off.
3) *Sw2-3:* This position is used to set the automatic skip-over perforation function.
   a) When this position is set to ON, the 1-inch automatic skip-over perforation will be performed, i.e., the paper automatically advances to the first line of the next page when the remaining page length is 1 inch.
   b) When this position is set to OFF, the 1-inch automatic skip-over-perforation will not be performed.
4) *SW2-4:* Forces automatic LF with each CR. When OFF, LF must be provided via software as needed. This position is used to fix $\overline{\text{AUTO FEED XT}}$ signal internally. The signal line is wired ORed with pin No. 14 of the interface connector. To control pin No. 14, leave this DIP switch in the OFF position.

2.4.3 SPECIFICATIONS OF JUMPER WIRES (Table 2-13)

Seven jumper wires are provided on the FXMB board. Their respective functions are as follows:

Table 2-13. Functions of Jumper Wires

Jumper No.	Description	Factory-Set Condition
J1	ON : Mask CPU OFF : Non mask CPU	Always OFF
J2	ON : 4K RAM OFF : 2K RAM	OFF
J3	ON : 4K RAM OFF : 2K RAM	OFF
J4	ON : Latches the data at the leading edge of $\overline{\text{STROBE}}$ pulse. OFF : Latches the data at the trailing edge of $\overline{\text{STROBE}}$ pulse.	OFF
J5	ON : PAGE LENGTH 11" OFF : PAGE LENGTH 12"	–
J6	ON : 8K ROM OFF : 2K RAM	ON : FX-85/185(105) OFF: FX-80+/100+
J7	ON : 2K RAM OFF : 8K ROM	ON : FX-80+/100+ OFF: FX-85/185(105)

NOTE:

J2 is for address selection at location 2A.

J3 is for address selection at location 3A.

J4 selects between data latching at the leading edge of $\overline{\text{STROBE}}$ signal and data latching at the trailing edge.

J6 and J7 are for selection between ROM and RAM at location 4A.

2.4.4 ALARM SYSTEM

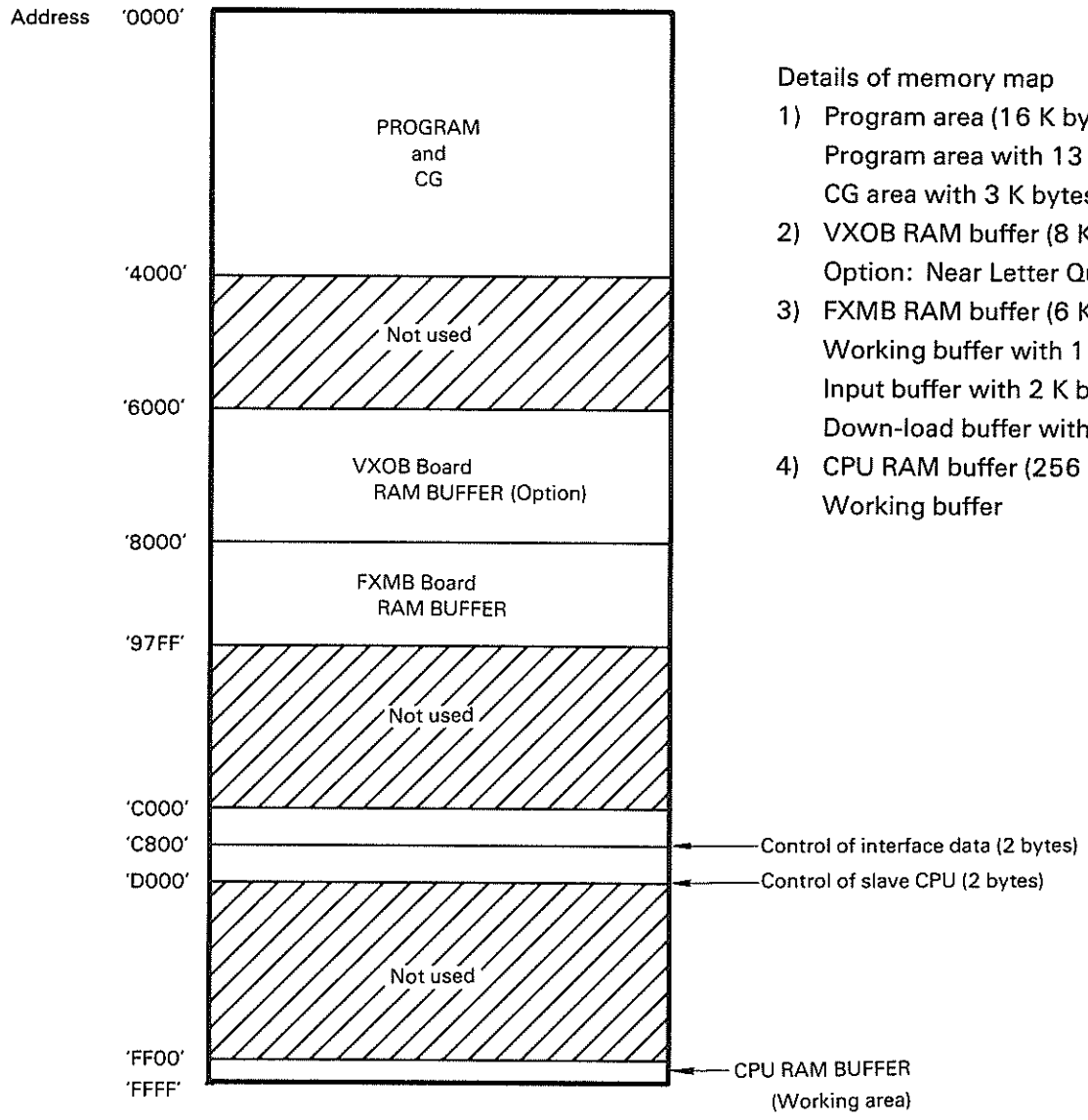
Both printer have a buzzer alarm system on the FXMB circuit board, which sounds a different alarm pattern for each of four possible error states.

1) Out-of-paper state detected: Pi, Pi, Pi, Pi (repeated 5 times)
   The buzzer is sounded when the printer runs out of paper, during printing.
2) Slave CPU detection error: Pi, Pi, Pi ... Pi, Pi, Pi
   When abnormality occurs in the carriage operation, the slave CPU detects it to sound the buzzer.
3) Head driver transistor short-circuited: Peep, Peep, Peep, Peep,
   With a short-circuit between the emitter and the collector, the buzzer is sounded.
4) Abnormally high voltage detected: Pi, Pi, Pi, Peep
   When the master CPU detects an abnormally high voltage (more than about 27V) in the +24V line, the buzzer is sounded.
   Errors 2, 3 and 4 above are regarded as hardware errors; each causes the +24V power supply to be cut off protect circuitry.

2.4.5 HARDWARE ERRORS

1) Slave CPU detection error
   - When the printer enters carriage operation mode and no PTS signal is detected for more than 10 msec.
     * The carriage does not move.
     * No PTS signal is output.
     * The control circuit has an abnormality.
2) Abnormally high voltage detected
   At power on, an abnormally high voltage (more than about 27 V) is detected by AN2 in the master CPU.
3) Head driver transistor short-circuited
   AN2 in the master CPU checks whether or not a short-circuit has occurred between the emitter and collector of a driver transistor. This check occurs during the print operation, when less than the specified voltage is detected.

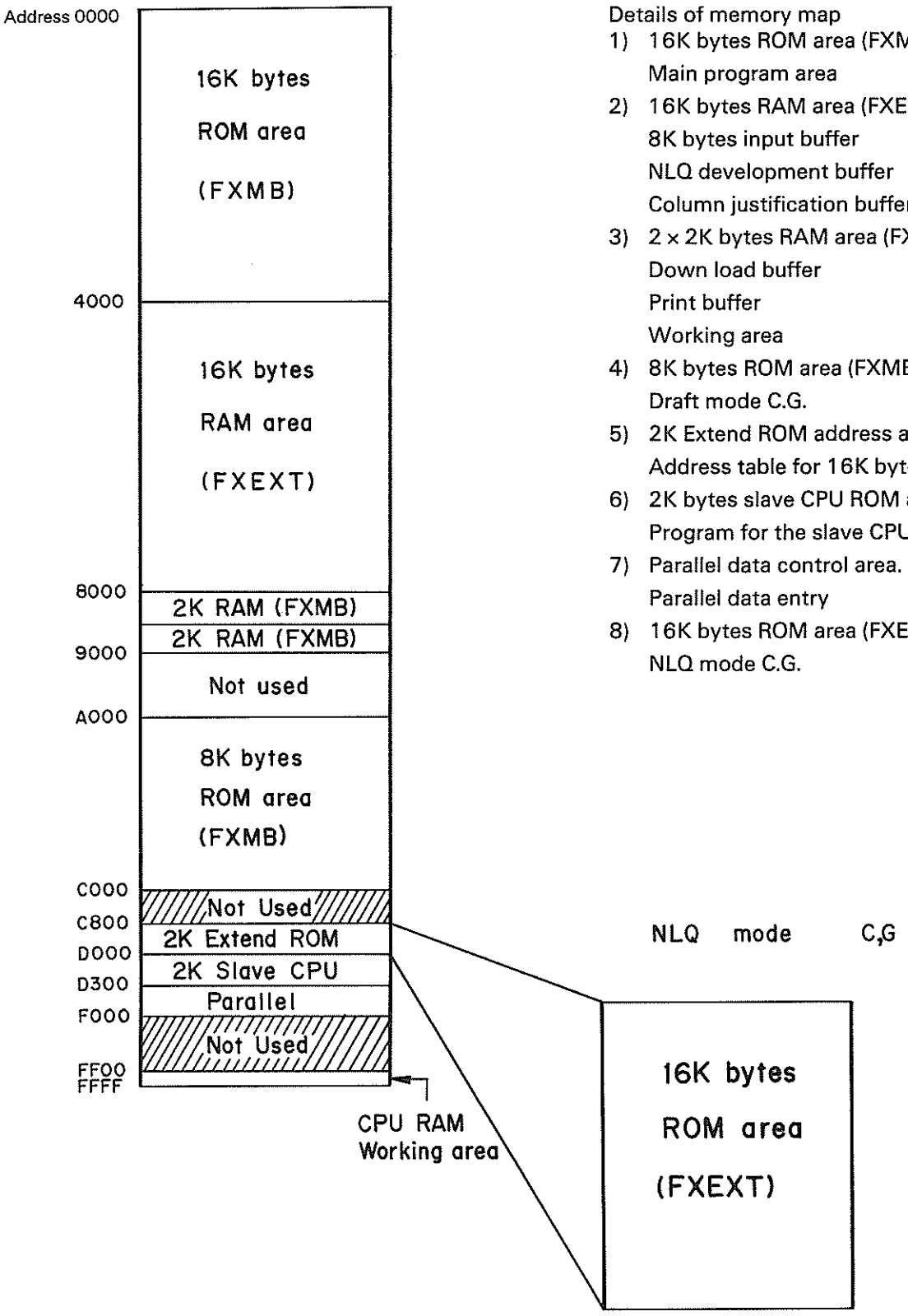
2.4.6 MEMORY MAP (Figs. 2-7 and 2-8)



Details of memory map

1) Program area (16 K bytes)
   Program area with 13 K bytes
   CG area with 3 K bytes
2) VXOB RAM buffer (8 K bytes)
   Option: Near Letter Quality
3) FXMB RAM buffer (6 K bytes)
   Working buffer with 1 K bytes
   Input buffer with 2 K bytes
   Down-load buffer with 3 K bytes
4) CPU RAM buffer (256 bytes)
   Working buffer

Fig. 2-7. Memory Map (FX-80+/100+)



Details of memory map

1) 16K bytes ROM area (FXMB)
   Main program area
2) 16K bytes RAM area (FXEXT)
   8K bytes input buffer
   NLQ development buffer
   Column justification buffer
3) 2 x 2K bytes RAM area (FXMB)
   Down load buffer
   Print buffer
   Working area
4) 8K bytes ROM area (FXMB)
   Draft mode C.G.
5) 2K Extend ROM address area
   Address table for 16K byte ROM
6) 2K bytes slave CPU ROM area
   Program for the slave CPU control
7) Parallel data control area.
   Parallel data entry
8) 16K bytes ROM area (FXEXT)
   NLQ mode C.G.

Fig. 2-8. Memory Map (FX-85/185/105)

2.4.7 DATA FLOW

The data flow sequence in the FX-80+/FX-100+ printers differs from that in the FX-85/FX-185(105) printers.

2.4.7.1 Data Flow of the FX-80+/FX-100+ (Fig. 2-9)

1) The data sent from the host computer are latched in IC 7A when the STROBE pulse is received.
2) The latched data are sent from IC 7A to the CPU (μPD7810G).
3) The input data to the CPU are stored in the input buffer (external 2K-byte RAM).
4) The data stored in the input buffer are gradually read by the CPU (μPD7810G).
5) The data read by the CPU are analyzed into two kinds of data—control codes and print data. The control codes are set as condition codes or parameters in the working area or tables of the CPU. The print data are stored in the print buffer (external 2K-byte RAM).
6) When the control code is identified by the CPU as CR or LF, print operation is performed.
7) The print data stored in the print buffer are read by the CPU (μPD7810G). Based on the print data, the CPU accesses the character generator in the main ROM.
8) The character generator outputs the character image data. The CPU reads these character image data and sends them to the printhead driver circuit for print-out.

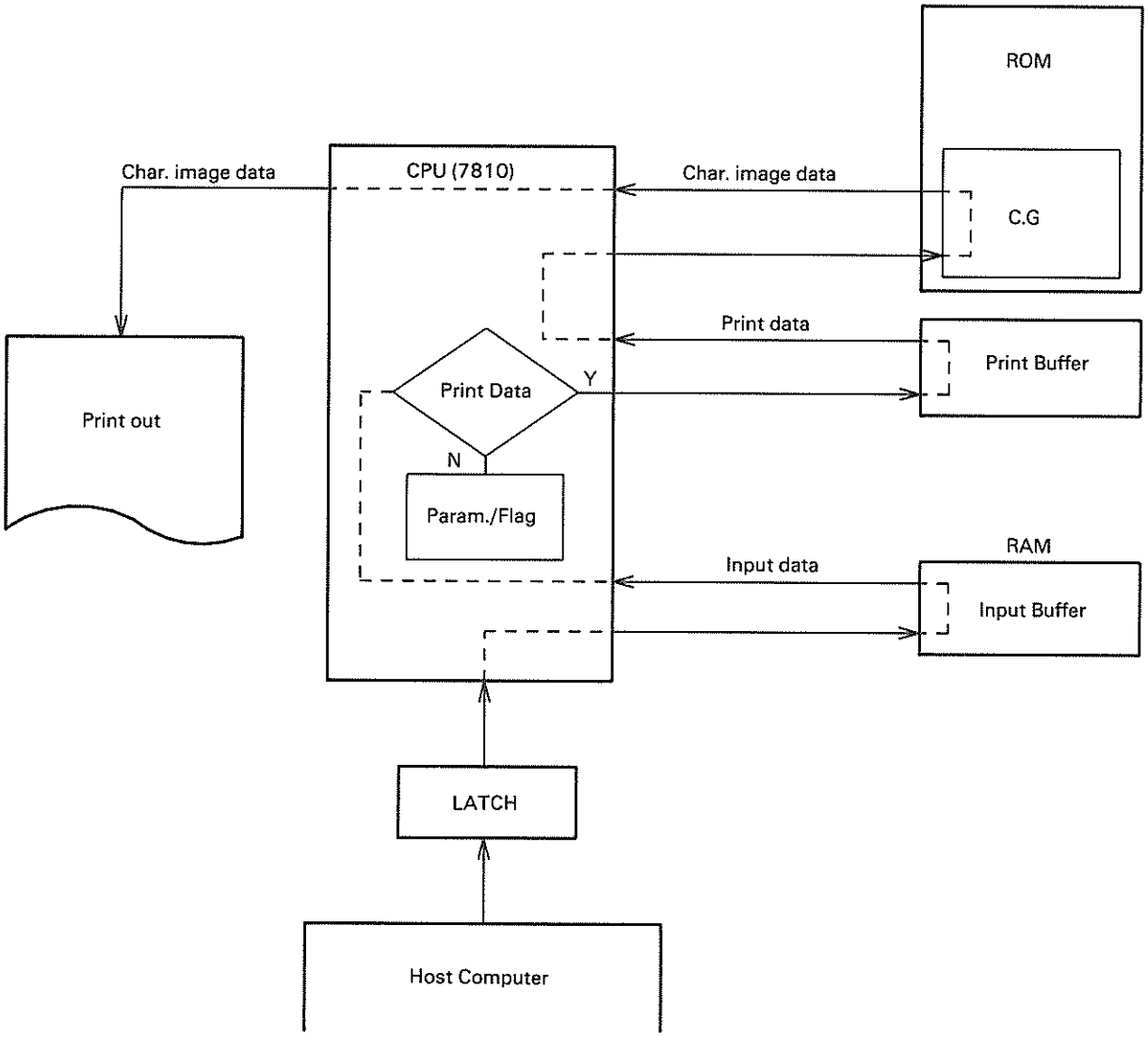


Fig. 2-9. Data Flow (FX-80+/100+)

2.4.7.2 Data Flow of the FX-85/FX-185(105)

The flow sequence in the FX-85/FX-185(105) printers differs in the draft mode from that in the NLQ mode.

* Draft Mode (Fig. 2-10)

1) The data sent by the host computer are latched in IC 7A when the STROBE pulse is received.
2) The data latched in IC 7A are sent to the CPU (μPD7810G).
3) The input data in the CPU are sent to the FXEXT and stored in the input buffer (8K-byte RAM) on the FXEXT board.
4) The data stored in the input buffer of the FXEXT are gradually read by the CPU.
5) The data read by the CPU are analyzed into two kinds of data (i.e. control codes and print data). The control codes are set as condition codes or parameters in the working area and tables of the CPU. The print data are stored in the print buffer (external 2K-byte RAM) on the FXMB.
6) When the control code is identified by the CPU as CR or LF code, print operation is performed.
7) The print data stored in the print buffer are read by the CPU. Based on the print data, the CPU accesses the character generator in IC 4A (8K-byte ROM) on the FXMB.
8) By accessing the character generator, the CPU reads the character image data, sending them to the printhead driver circuit for print-out.

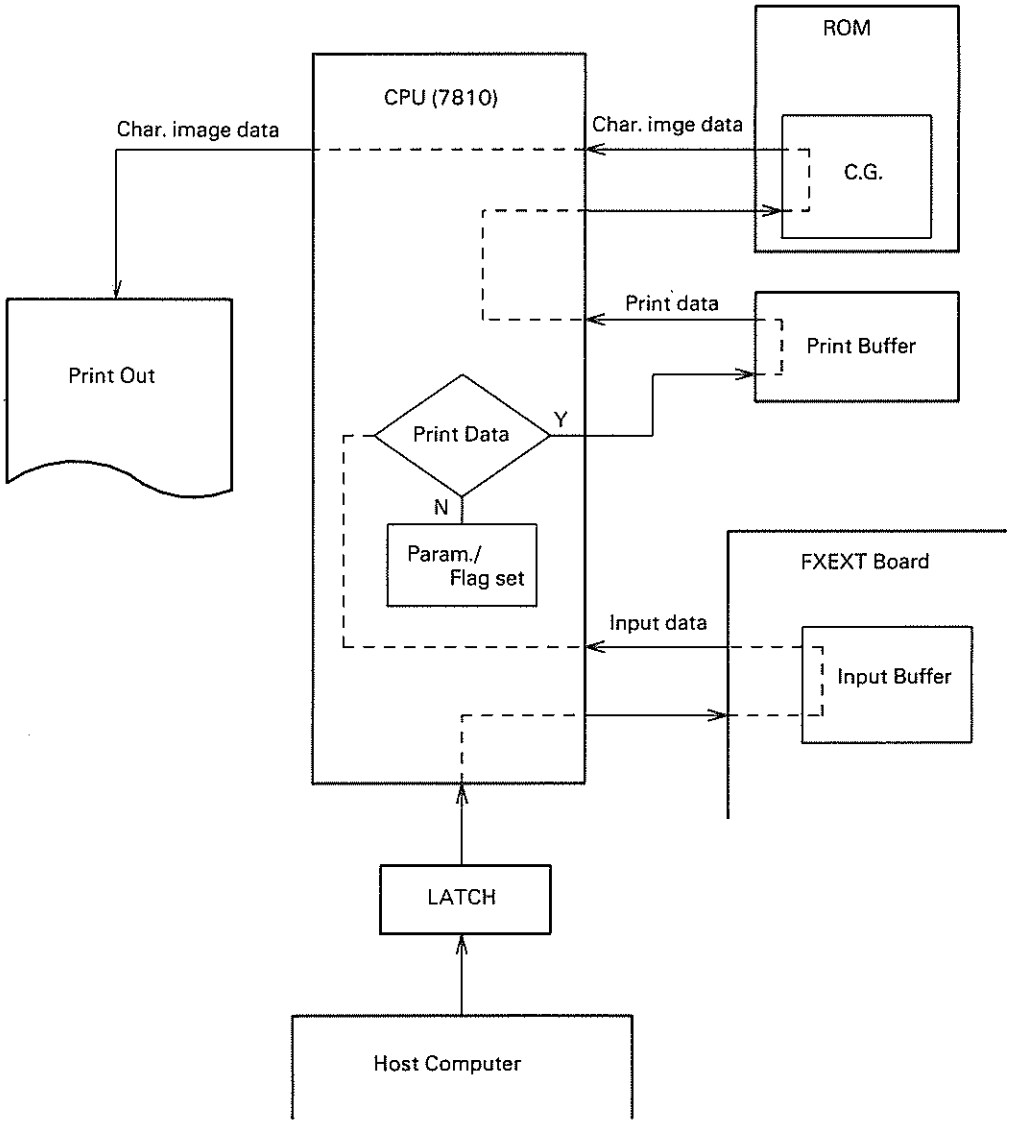


Fig. 2-10. Data Flow in Draft Mode (FX-85/FX-185/105)

* NLQ Mode

1) The data sent by the host computer are latched in IC7A when the STROBE pulse is received.
2) The data latched in IC7A are sent to the CPU (μPD7810G).
3) The input data are then sent from the CPU to the FXEXT and stored in the input buffer (8K-byte RAM) on the FXEXT board.
4) The data stored in the input buffer of the FXEXT are gradually read by the CPU.
5) The data read by the CPU are separated into two kinds of data (i.e. control data and print data).
   The control codes are set as condition code or parameters in the working area and tables of the CPU. When the CPU recognizes the control code for NLQ (e.g. ESC "x" 1), the printer is in the NLQ mode. After the printer is into the NLQ mode. The print data changed to NLQ image data, and stored in the NLQ development buffer (8K-byte RAM) on the FXEXT. Based on the print data, the CPU accesses the NLQ character generator in IC5A (16K-byte ROM) on the FXEXT.
6) When the control code is identified by the CPU as CR or LF code, print operation is performed.
7) The NLQ image data stored in the NLQ development buffer are read by the CPU, and sent to the printhead driver circuit for print-out.
   The NLQ printing requires two cycles of this operation.

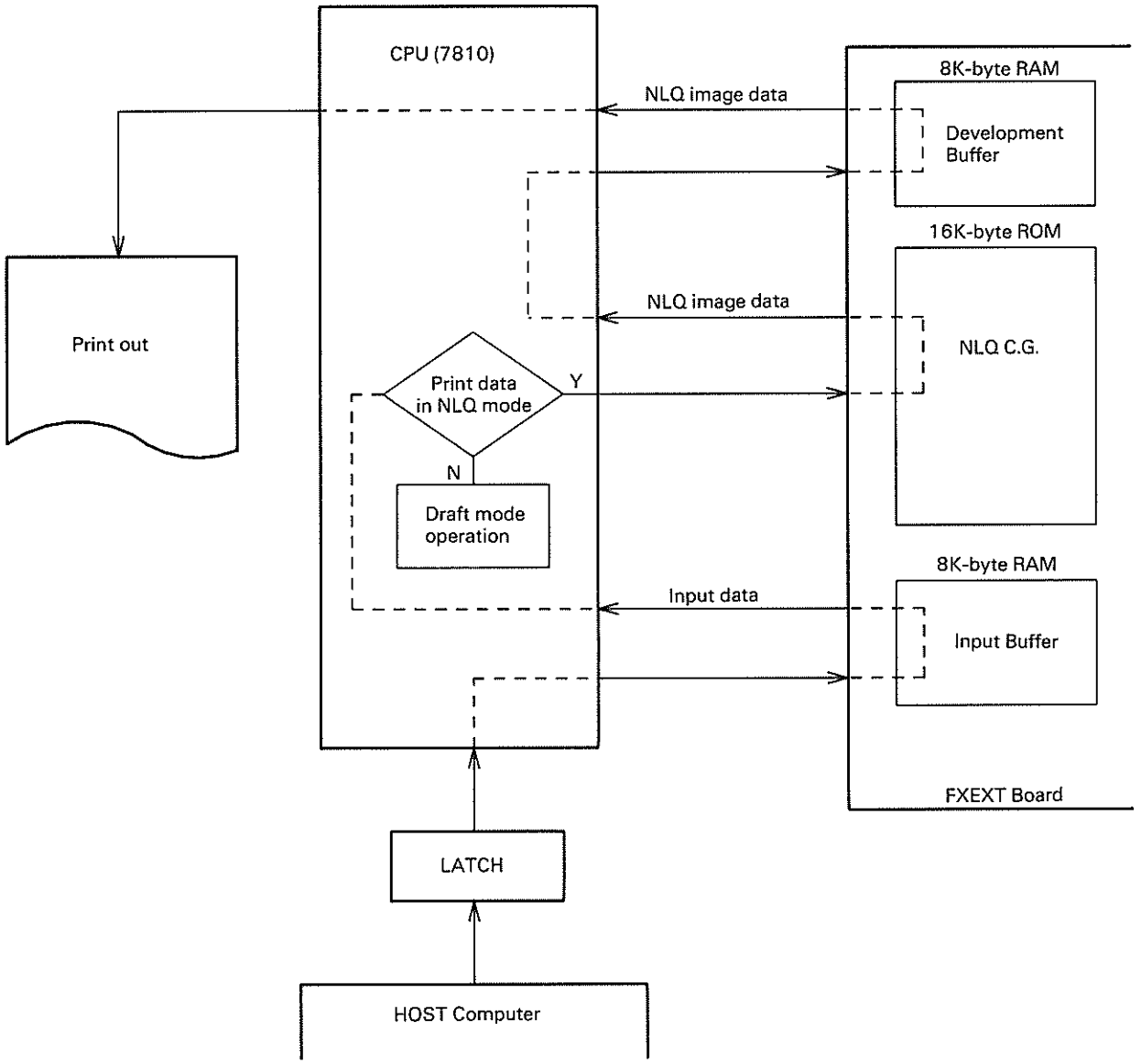
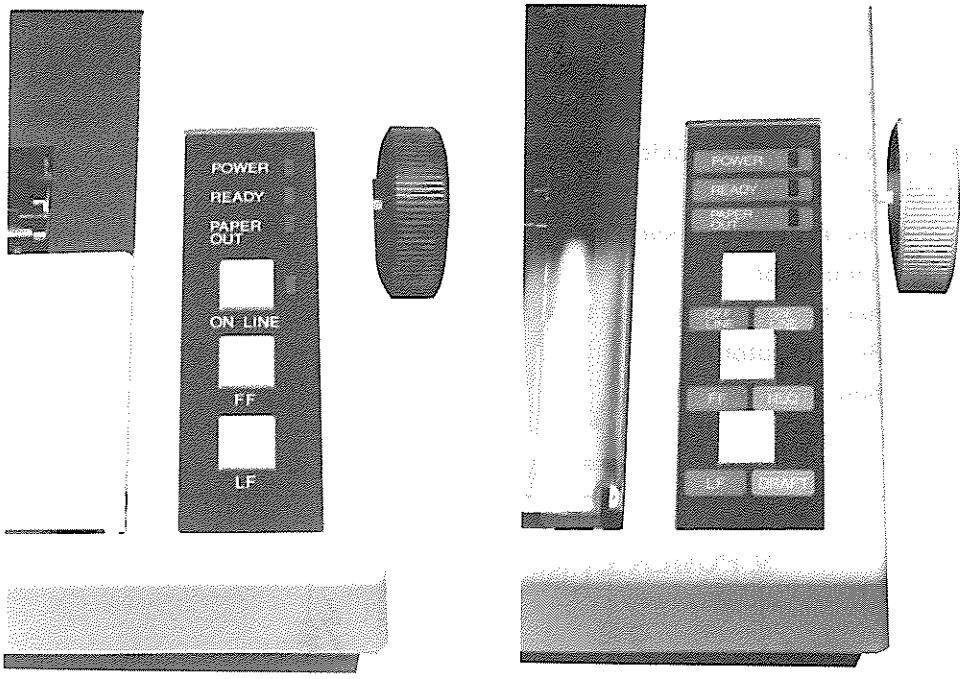


Fig. 2-11. Data Flow in NLQ Mode (FX-85/FX-185/105)

2.5 CONTROL PANEL

There are three switches and four indicators in the control panel. Functions of these switches and indicators are described as follows:



FX-80+/100+ FX-85/185 (105)

Fig. 2-12. Control Panels

2.5.1 SWITCHES

(1) ON-LINE Switch: non lock type push switch

1) Switches between the on-line and off-line modes.
2) The printer is automatically set to the on-line mode and ready to receive data from the host computer. In case of models; FX-85/185/105, the printer can receive data from the host computer immediately after the power switch is turned on. If the printer is set to the off-line mode while it is receiving data from the host computer, data already received will be printed.

(2) FF Switch: non lock type push switch

1) When this switch is depressed once during off-line mode, the paper is advanced vertically to the next to form position.
2) The beginning of page is set in one of the following cases:
   - When the power switch is turned on.
   - When the $\overline{\text{INIT}}$ signal is input.
   - When the software reset command (ESC @) is input.
   - When the page length set command (ESC C) is input.
3) The default page length depends on the J5 jumper setting and can be changed with the page length set command.
4) During on-line mode, this switch can be selected the NLQ mode printing. (FX-85/185/105 models only)

(3) LF Switch: non-lock type push switch

1) When the printer is in the off-line mode, the paper advances continuously while this switch is depressed.
2) During on-line mode, this switch can be selected the Draft mode printing. (FX-85/185/105 models only)

2.5.2 INDICATORS

The following four indicators are provided on the control panel.

1) POWER: Green indicator
   Lights up when AC power is supplied.
2) READY: Green indicator
   Lights up when the printer is ready to receive data.
3) PAPER OUT: Red indicator
   Lights up when the paper is out.

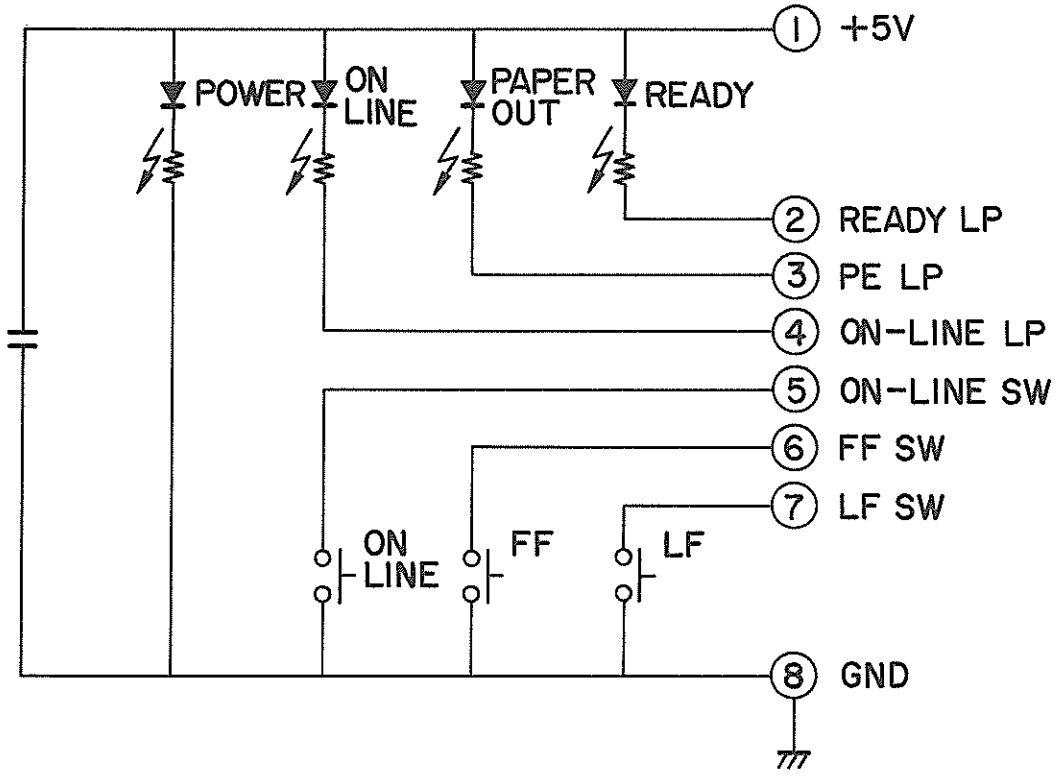


Fig. 2-13. Control Panel (FPEL) Circuit

2.5.3 CONTROL PANEL PRINT MODE SELECTION

Printers are capable of operating in several print modes selectable via both software and a control panel push button sequence. Selectable modes and their control panel selection codes (finger print codes) are listed in Table 2-14.

Table 2-14. Control Panel Mode Selection Codes

Selection Code*	Function
1	Condensed Mode
2	Enlarged Mode
3	Elite Mode
4	Emphasized Mode
5	Italic Mode
6	Double Strike Mode
7	Underline Mode
8	Superscript Mode
9	Subscript Mode
10	One-inch Skip Perforation Mode

* Instructions: To use control panel mode setting or to clear previously set instructions, depress the ON-LINE and FF switches simultaneously; then depress the LF and FF switches once each. The appropriate code may then be selected.

The control panel mode selection functions are enabled as follows:

1) Turn the printer on and depress the ON-LINE and form feed (FF) switches simultaneously. A short buzzer signal will sound and the on-line lamp will begin to flash, signaling that the printer is in the "finger printing" mode.
2) Refer to Table 2-14 and locate the desired print function. The number (i.e., the selection code) next to each function in the table denotes the number of times the ON-LINE switch must be depressed to enable this print feature. Depress the ON-LINE switch the desired number of times. For example, to select the elite mode function, depress the ON-LINE switch three times.
3) Depress FF to set the mode you have just selected.
4) To select more than one feature, when you have completed the instructions for the first selection (steps 1 – 3) return to step 2 above and begin the process again, selecting the second code (e.g., bold mode, selection code 4, may be selected in addition to elite typeface.)
5) Depress LF to terminate the panel setting and the printer is in the off-line mode.
6) Depress ON-LINE switch, placing the printer in the ready to print mode.
7) To cancel the finger-printing function, depress the ON-LINE and FF switches simultaneously.

2.6 ELECTRIC CIRCUITRY

2.6.1 POWER CIRCUIT

The power circuit in the printer is composed as shown in Fig. 2-14. The AC input power is supplied to the power transformer through the filter circuit. The outputs from the secondary side of the power transformer are input to the FXMB circuit board and converted into DC voltages via the regulator circuit. These DC voltages are supplied to their respective corresponding electronic circuits.

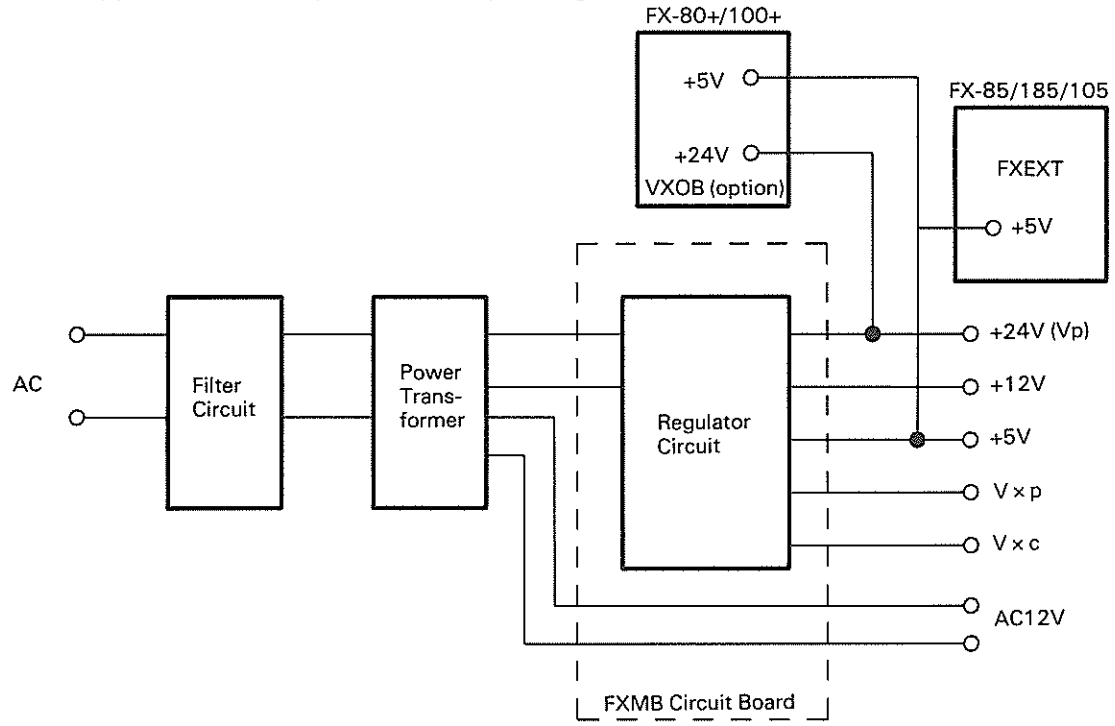


Fig. 2-14. Block Diagram of Power Circuit

Table 2-15. Types and Applications of Power

Voltage	Application
+24V (VP)	① Carrige motor drive ② Paper feed motor drive ③ Print solenoid drive ④ Interface option circuit board power
+5V (Vcc)	① FXMB logic circuit drive ② Carriage motor holding ③ Paper feed motor holding ④ Indicator lamp drive ⑤ Interface option circuit board power ⑥ FXEXT logic circuit drive
+12V	① Interface option circuit board power
AC12V	① Interface option circuit board power
V×c (+5V)	① Power reset ② Buzzer power
V×P (+5V)	① Print solenoid protection

2.6.1.1 Filter Circuit (Figs. 2-15 and 2-16)

The filter circuit is situated on the FFIL circuit board together with the printer power switch and fuse. The power cable is also connected to the filter circuit board.

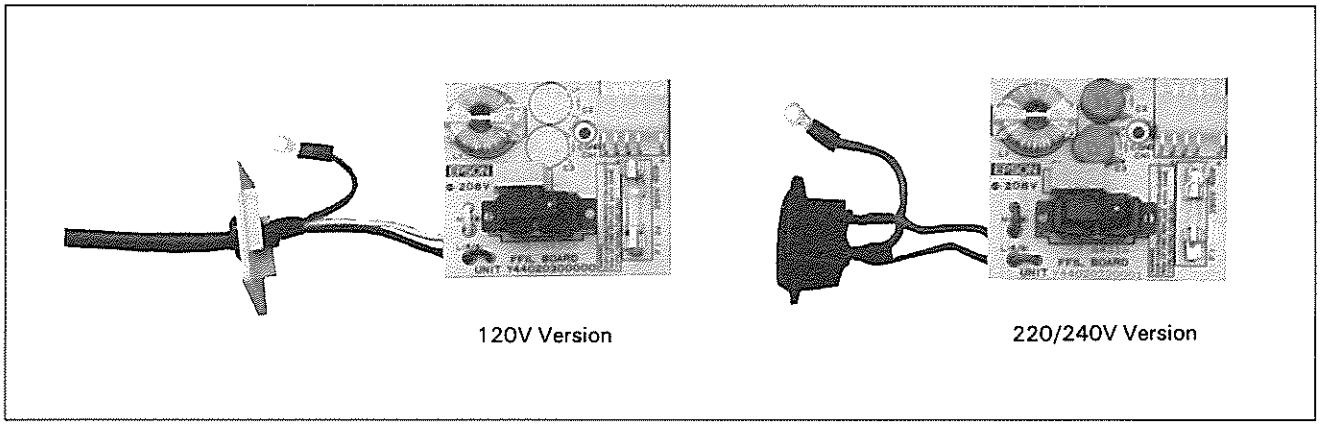


Fig. 2-15. Filter Circuit Components

The AC input from the power line first flows across the power switch and fuse F1. After being filtered out by C1, it is supplied to the primary side of the power transformer via the LC noise prevention circuit.
Power line noise (external noise) into the printer and noise (internal noise) occurring from the printer are eliminated by this noise prevention circuit. Capacitors C2 and C3 are not used for 120V version.

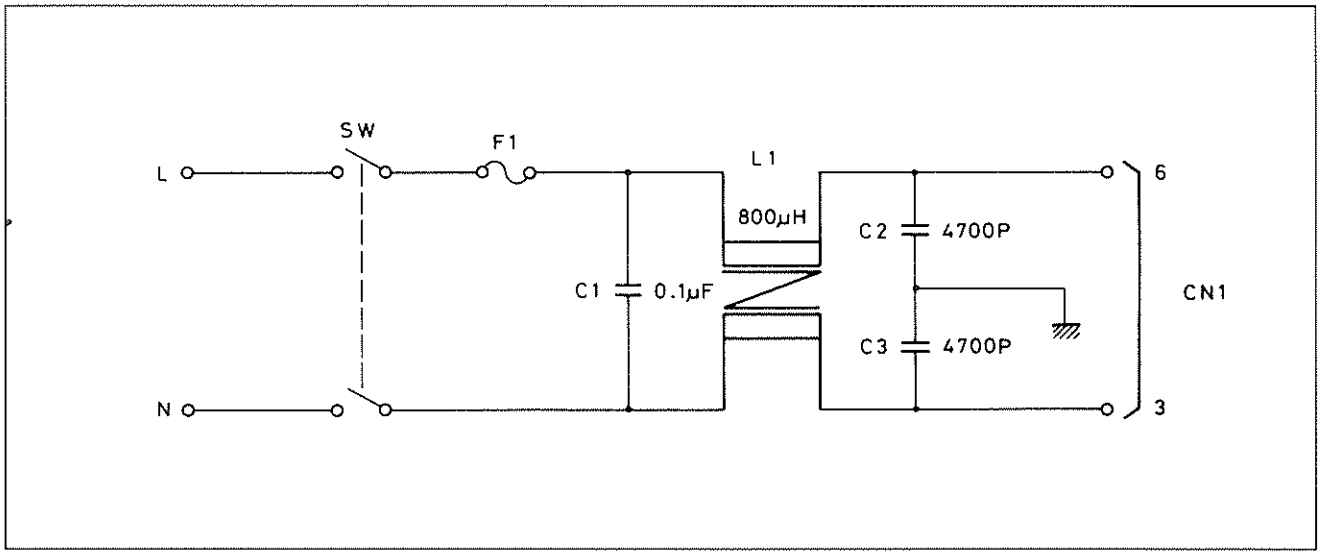


Fig. 2-16. Fuse and Filter Circuit

2.6.1.2 Power Transformer (Fig. 2-17)

In the Printer, the power transformer changes the AC input into AC 26V and AC 12V through the filter circuit and supplies necesary voltages to the control circuit and option interface circuit.

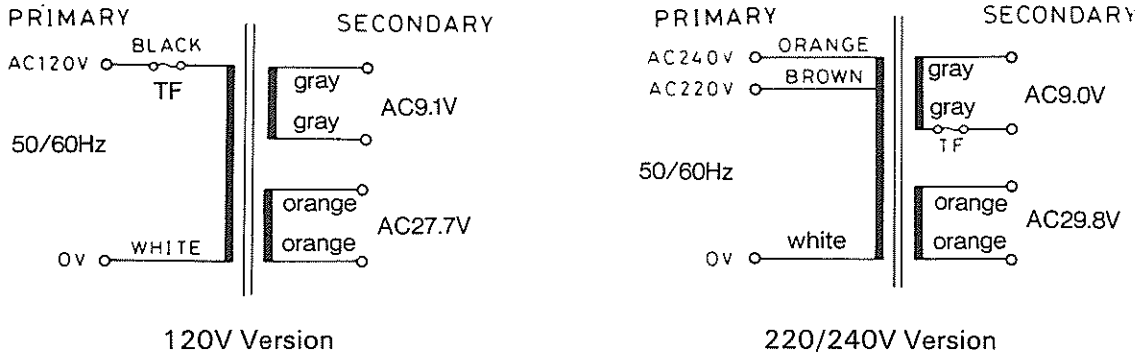


Fig. 2-17. Power Transformer Windings

2.6.1.3 Regulator Circuit (Fig. 2-18)

In this circuit, the output (about 38 V) from the secondary side of the transformer is input to the diode bridge DB1 in which it is full-wave rectified. In this way, constant voltage outputs of +24V and +5V are obtained from the chopper type regulator IC1.

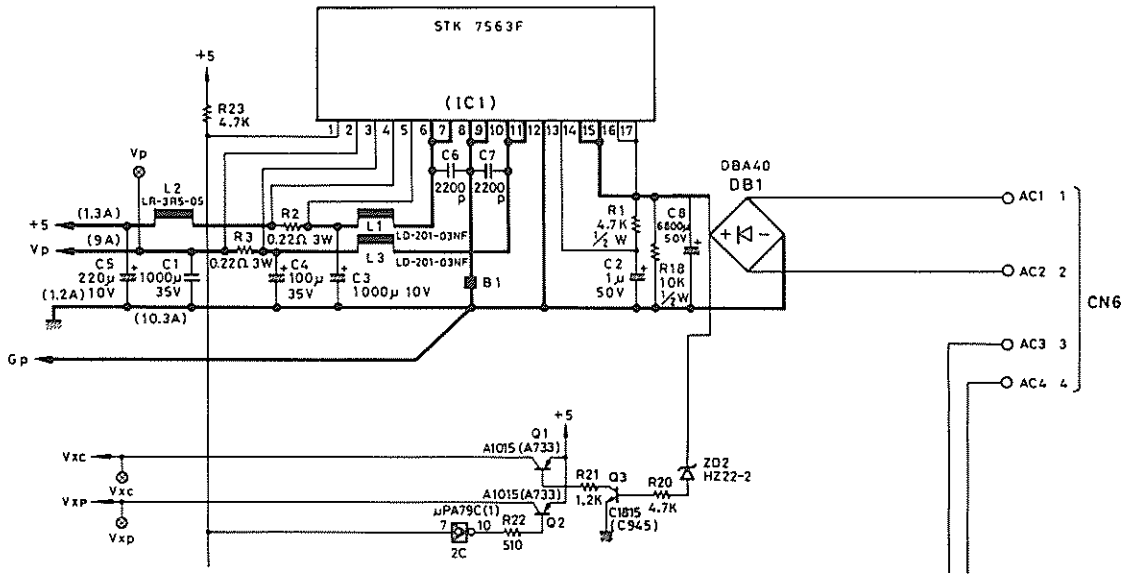


Fig. 2-18. +24V/+5V Regulator Circuit

(1) Operating Principle of Chopper Type Switching Regulator

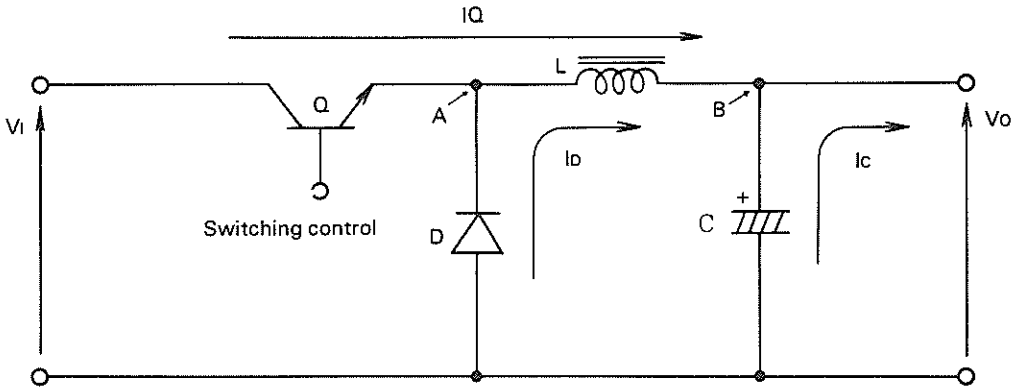


Fig. 2-19. Typical Switching Regulator Circuit

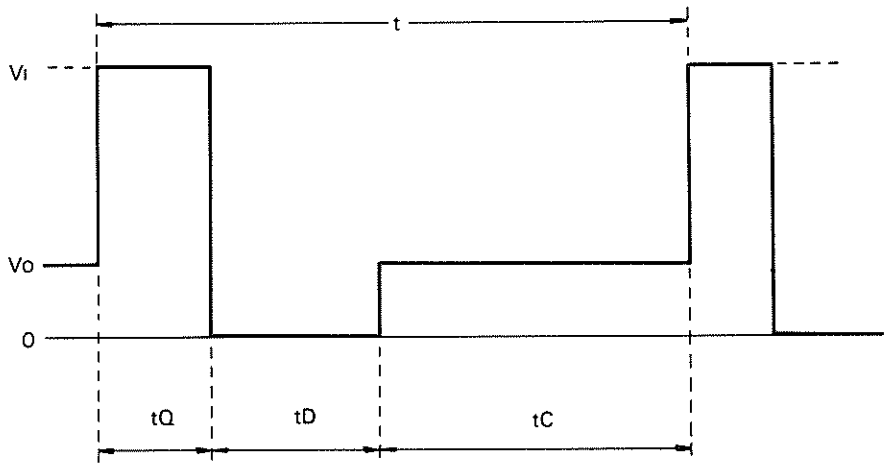
The operating principle of the switching regualtor is illustrated above.
The output voltage Vo is supplied as explained below:

Mode 1: When transistor Q is on, the input voltage VI supplies energy to the inductance L and capacitor C, causing a current IQ to flow.

Mode 2: When transistor Q is off, the energy stored in inductance L passes through diode D, causing a current ID to flow.

Mode 3: When transistor Q and diode D are both off, the energy stored in the capacitor C causes to flow.

(Voltage at point A)



(Voltage at point B)

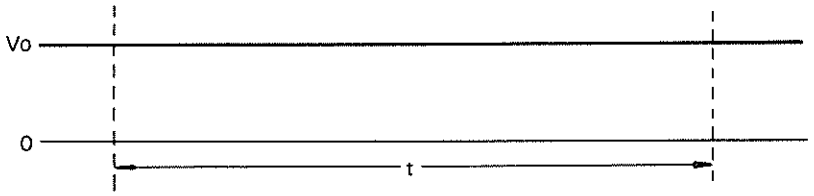


Fig. 2-20. Voltage Waveform

(2) Operation of Switching Regulator IC (STK7563)

The regulator circuit consists of a one chip switching regulator IC (STK7563), which stabilizes +5 V and +24 V, consists of five blocks, as shown in its equivalent circuit in Figs. 2-8 and 2-9.

1. Oscillation circuit
2. Power switch
3. Output voltage control circuit
4. Overcurrent protection circuit
5. +24 V ON/OFF control circuit

1) Oscillation Circuit

This oscillation circuit, consisting of two CMOS gates, oscillates at 35 kHz (duty cycle 80%). When the power switch is turned ON, current flows to the switching regulator IC (STK7563) and the oscillation circuit emits a pulse signal.

2) Power Switch

The output voltages are kept constant by ON/OFF control of the power switch by this pulse.

Power switching transistors Q1 and Q6 are controlled by the output voltage control circuit. Thus, the output +5 and +24 V are kept constant.

3) Output Voltage Control Circuit

a) For +5 V

Transistor Q3 monitors the voltage at resistor RS1 in the output side of +5 V to control its collector voltage. Thereby, the time constant of capacitor C2 and resistor R8 changes to control the ON/OFF time of transistor Q1.

b) For +24 V

Transistor Q8 and zener diode ZD2 monitor the voltage at resistor RS2 in the output side of +24 V. Thereby, the time constant of capacitor CS and resistor R15 changes to control the ON/OFF time of transistor Q6.

4) Overcurrent Protection Circuit

a) For +5 V

The current amount is monitored by transistor Q5, and resistors R3 and RS1. When an overcurrent flows at resistor RS1, a voltage appears between the base and collector of transistor Q5 to turn it ON. When transistor Q5 is turned ON, a current flows at the base of transistor Q4 to turn it ON. When transistor Q4 is turned ON, the time constant of capacitor C2 and resistor R8 changes as in the output voltage control circuit, to cut off power switching transistor Q1.

b) For +24 V

The current amount is monitored by transistor Q9 and resistors R19 and RS2. When an overcurrent flows at resistor RS2, transistor Q9 turns ON and then transistor Q8 turns ON. When transistor Q8 turns ON, the time constant of capacitor CS and resistor R15 changes to cut off power switching transistor Q6.

5) +24 V ON/OFF Control Circuit

When a hardware error is detected in the Printer, the main CPU emits a LOW PS cut signal. The signal enters pin 1 of the switching regulator IC, cutting off transistor Q11. When transistor Q11 is cut off, transistor Q10 turns ON to block oscillation at the +24 V side. Thus, power switching transistor Q6 is cut off to stop the output of +24 V.

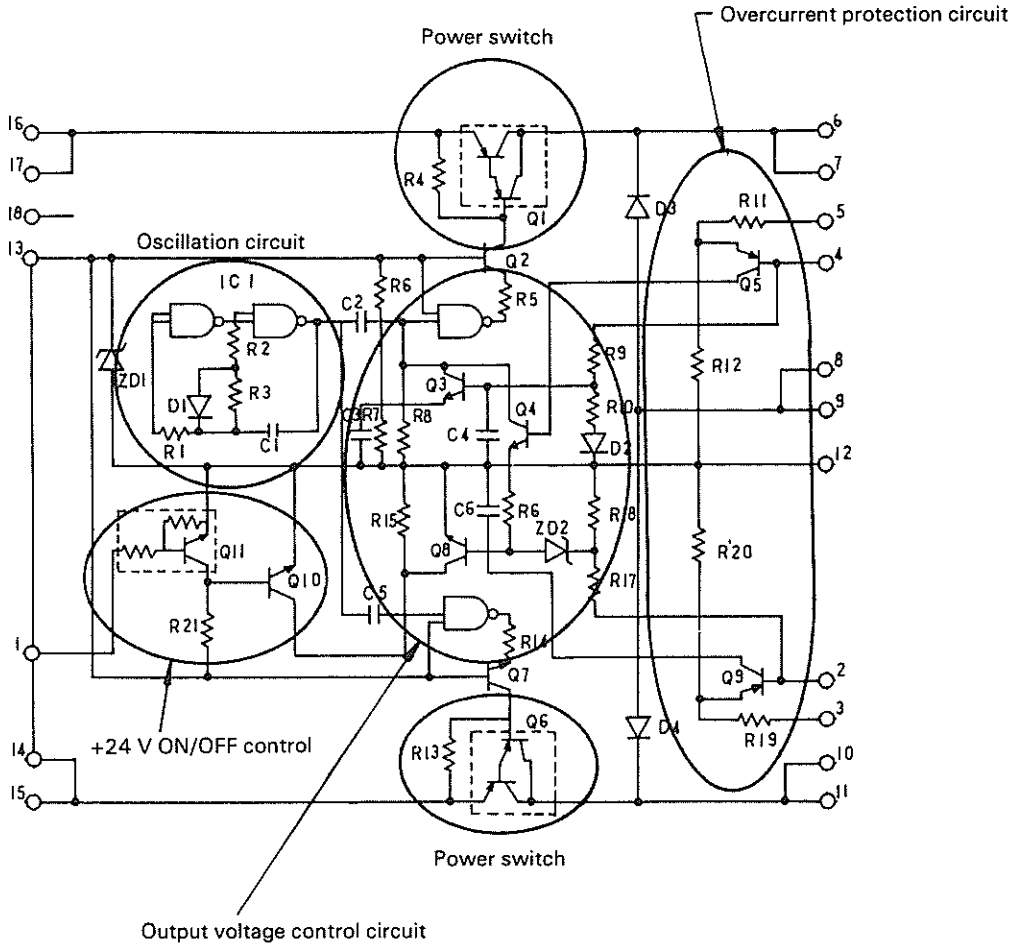


Fig. 2-21. STK 7563F Regulator IC Circuitry

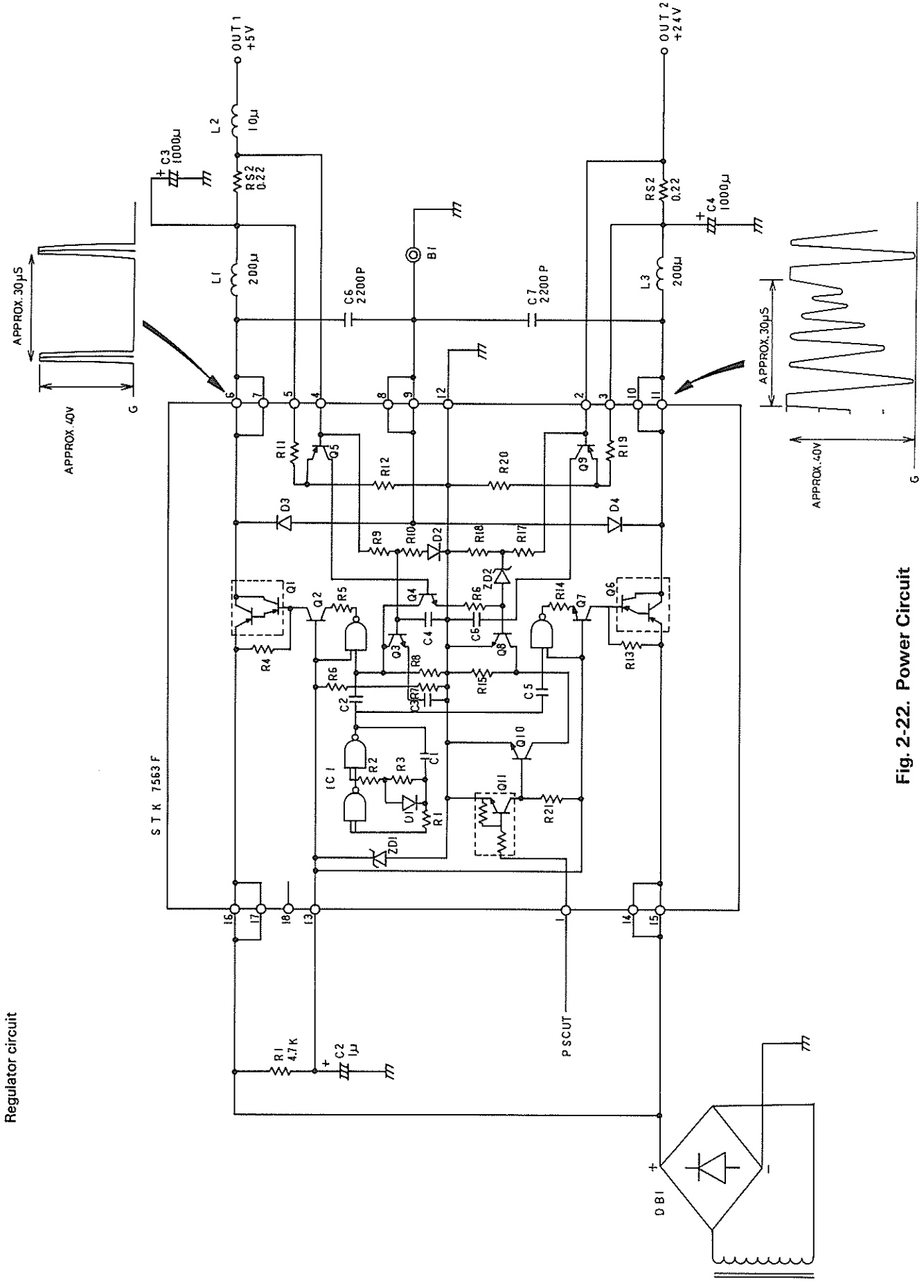
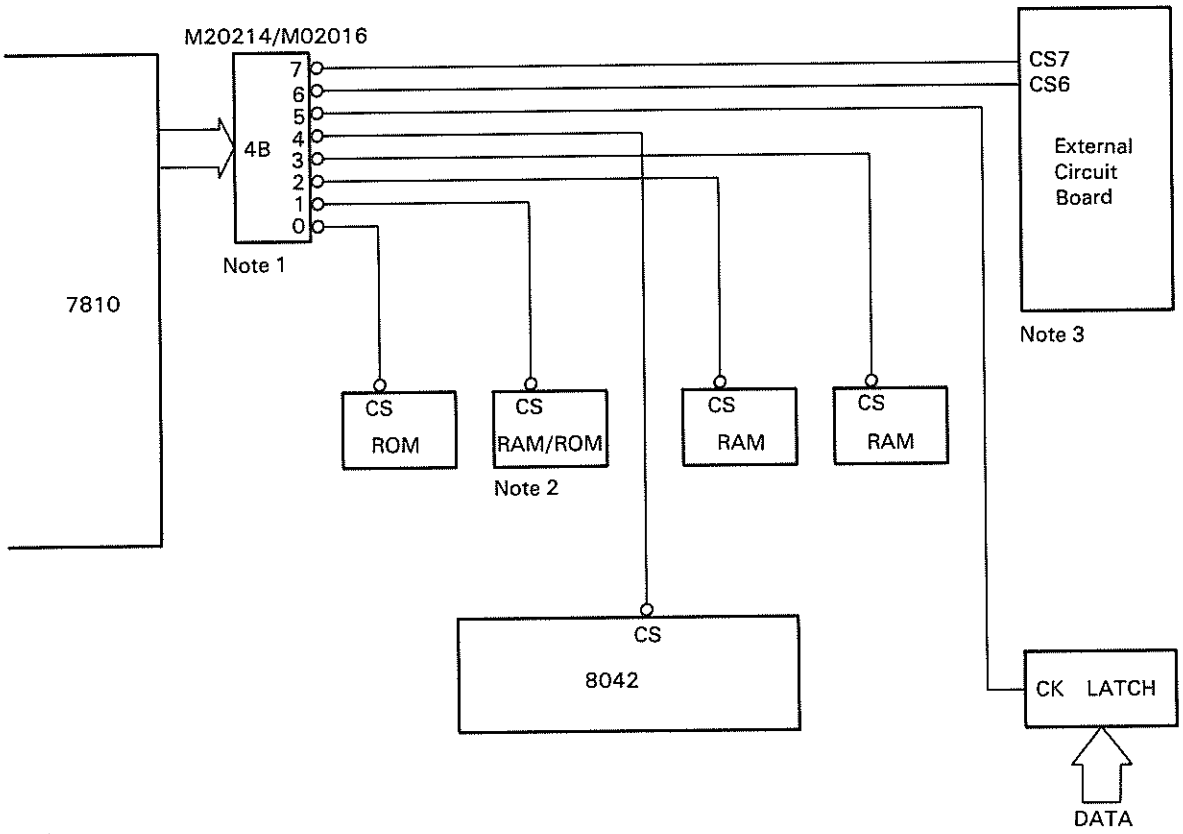


Fig. 2-22. Power Circuit

Regulator circuit

2.6.2 FUSE ROM CHIP SELECTION CIRCUIT

The CPU (μPD7810G) inputs the address data into the fuse ROM (IC 4B). Based on the input address data in IC 4B, the fuse ROM (M20214GA/M02016GA) selects one chip from among the RAMs, the ROMs, and the slave CPU. Figure 2-23 shows the chip selection circuit.



NOTES:

1. M20214GA: FX-80+/100+
   M02016GA: FX-85/185(105)
2. 2K-byte RAM: FX-80+/100+
   8K-byte ROM: FX-85/185(105)
3. VXOB (option): FX-80+/100+
   FXEXT: FX-85/185(105)

Fig. 2-23. Chip Selection Circuit

2.6.3 FXEXT BOARD FUNCTIONS (FX-85/FX-185/FX-105)

The FXMB board inputs two chip-select signals (CS6 and CS7) into the FXEXT circuit board. According to the impedance level of these input signals, the FXEXT board selects and IC chip(s). Table 2-16 lists the signal levels for IC selections.

Table 2-16. Signal levels and IC Selections

$\overline{CS7}$	$\overline{RD}$	$\overline{WR}$	$\overline{CS6}$	A13	IC Selection
L	—	—	—	—	Selects the 16K-byte ROM
L	—	L	—	—	Latches the high address data to the IC 5B
—	L	—	—	—	Output Enable (OE) for the 16K-byte ROM and 8K-byte RAMs
—	—	—	L	L	Selects the 8K-byte RAM (IC 3A)
—	—	—	L	H	Selects the 8K-byte RAM (IC 1A)
—	L	—	H	—	Refreshes ICs 1A and 3A
—	—	L	H	—	Refreshes ICs 1A and 3A
—	L	—	L	—	Chip Enable (CE) for ICs 1A and 3A
—	—	L	L	—	Chip Enable (CE) for ICs 1A and 3A
—	—	L	—	—	Write Enable (WE) for ICs 1A and 3A
—	—	—	H	—	Write Enable (WE) for ICs 1A and 3A

NOTE:
"L" = Low level, "H" High level, and "—" = High or Low level.

2.6.4 CARRIAGE CONTROL

The operation of the carriage is controlled by the slave CPU (8042). The output from the predriver circuit (IC 8C) is input to the carriage drive IC (STK6982) to operate the carriage. When the carriage is operated, pin 24 of the slave IC becomes LOW Normal Speed, cutting off transistors Q16 and 17.

When transistors Q16 and 17 are cut off, the differential amplifier in IC2 (STK6982) supplies +24 V to the carriage motor coils. Concurrently, the RUSH signal is supplied to IC2 (STK6982) from the slave CPU. In this way, supply of +24 V to the motor coils is carried out beforehand.

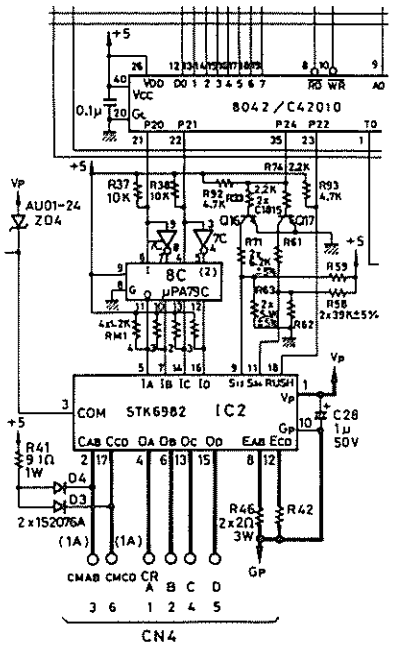


Fig. 2-24. Carriage Control Circuit

2.6.4.1 Timing of Carriage Signal

The RUSH signal (from pin 22 of the slave CPU) is LOW during acceleration, constant speed, or deceleration of the carriage, and the current flowing at the carriage motor coils is of chopper waveform. At start of the carriage motor, the RUSH signal goes LOW; phase selection is made after 20 msec.

While the motor is not operating the RUSH signal is HIGH. At this time, a +5 V holding current is emitted across the motor coils through diodes D3 and D4. IC2 signals, S12 and S34, make pin 24 of the slave CPU (8042) HIGH at normal speed of the carriage and LOW at half speed. The time from the phase selection at non operation to the initial phase selection for restarting is approx. 100 msec.

2.6.4.2 Detection of Abnormal Operation of Carriage and Its Protection

When a voltage overload occurs during carriage operation, the carriage motor may stop. If the motor is stopped for a long period, it may burn out due to overheating. To prevent this burn-out, the printer checks whether or not the PTS signal is detected even after 20 msec from the motor phase selection. If the PTS signal is not detected, supply of +24 V is dropped (refer to item 2.3.6) to alert the slave CPU to an error.

2.6.4.3 Carriage Motor Drive Sequence

Method of Control

The carriage drive motor in the printer mechanism, which uses a pulse motor, permits the carriage to stop at an arbitrary position or to change the print direction by control of acceleration or deceleration. Control is achieved by comparing the time set by the firmware and the PTS signal, detected when the carriage operates.

a) When driving the carriage from left to right

Table 2-17. Carriage Motor Step Sequence (CW)

STEP	A phase	B phase	C phase	D phase
1	ON	OFF	OFF	ON
2	ON	OFF	ON	OFF
3	OFF	ON	ON	OFF
4	OFF	ON	OFF	ON

b) When driving the carriage from right to left

Table 2-18. Carriage Motor Step Sequence (CCW)

STEP	A phase	B phase	C phase	D phase
1	ON	OFF	ON	OFF
2	ON	OFF	OFF	ON
3	OFF	ON	OFF	ON
4	OFF	ON	ON	OFF

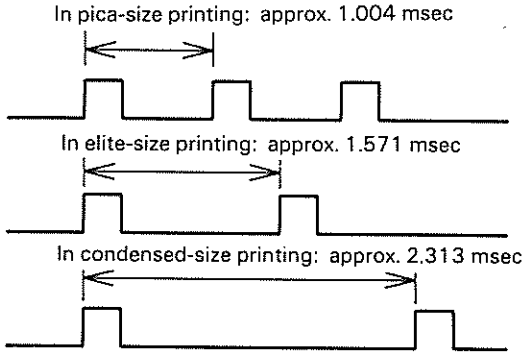


Fig. 2-25. Carriage Speed

2.6.4.4 Speed Comparison (Fig. 2-26 and 2-27)

1) When the PTS signal is detected later than the set time, phase selection is made at the leading edge of the PTS signal.

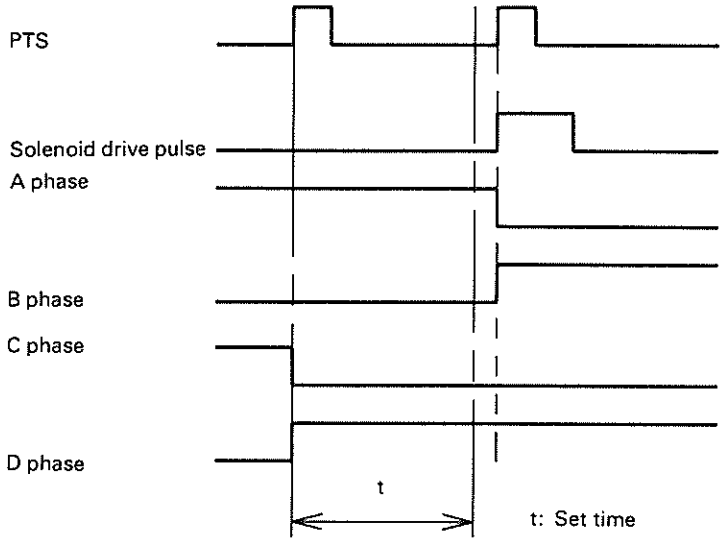


Fig. 2-26. Carriage Speed (Too Slow)

2) When the PTS signal is detected earlier than the set time, the phase selection is made at the leading edge of the PTS signal.

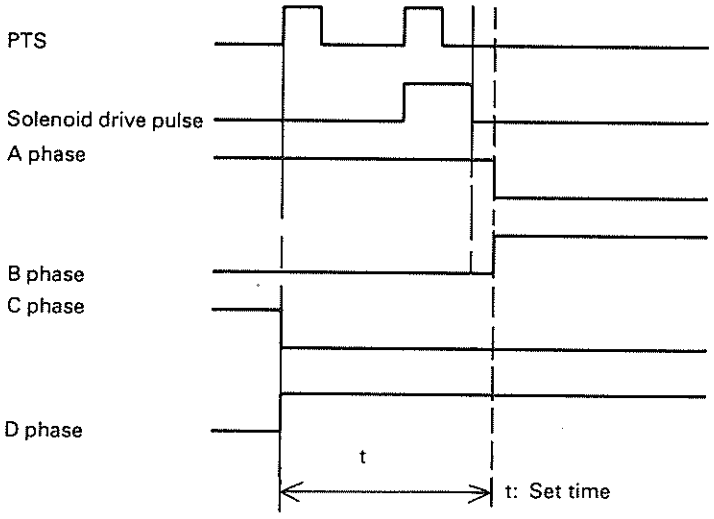
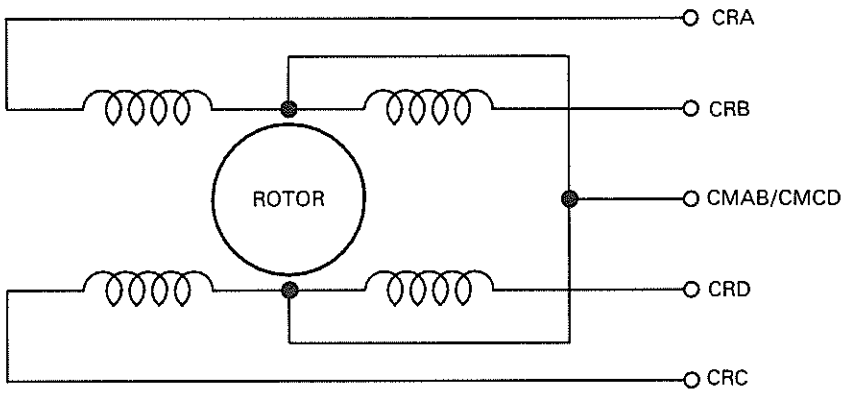


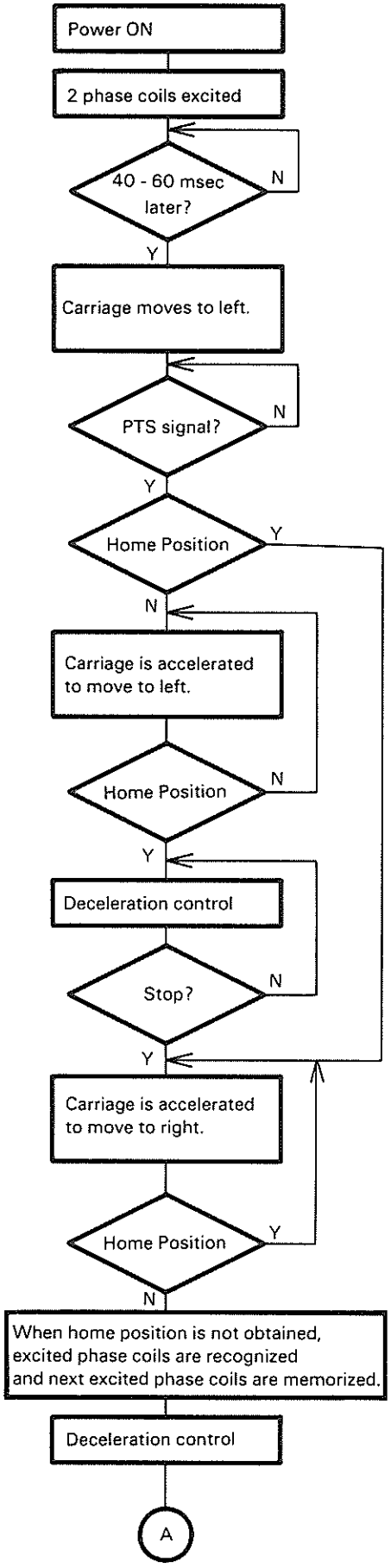
Fig. 2-27. Carriage Speed (Too Fast)

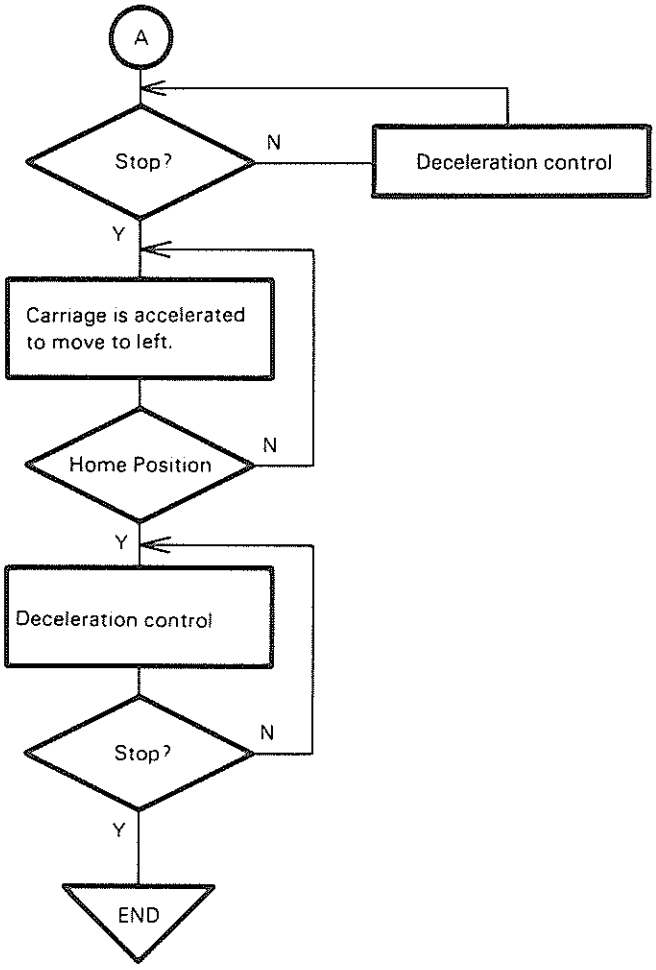


Coil impedance: 12 ohms + 7% (at 25°C)

Fig. 2-28. Carriage Motor Connections

2.6.4.5 Flow of Home Position Seek Operation





Signal timing for home-position seek operation

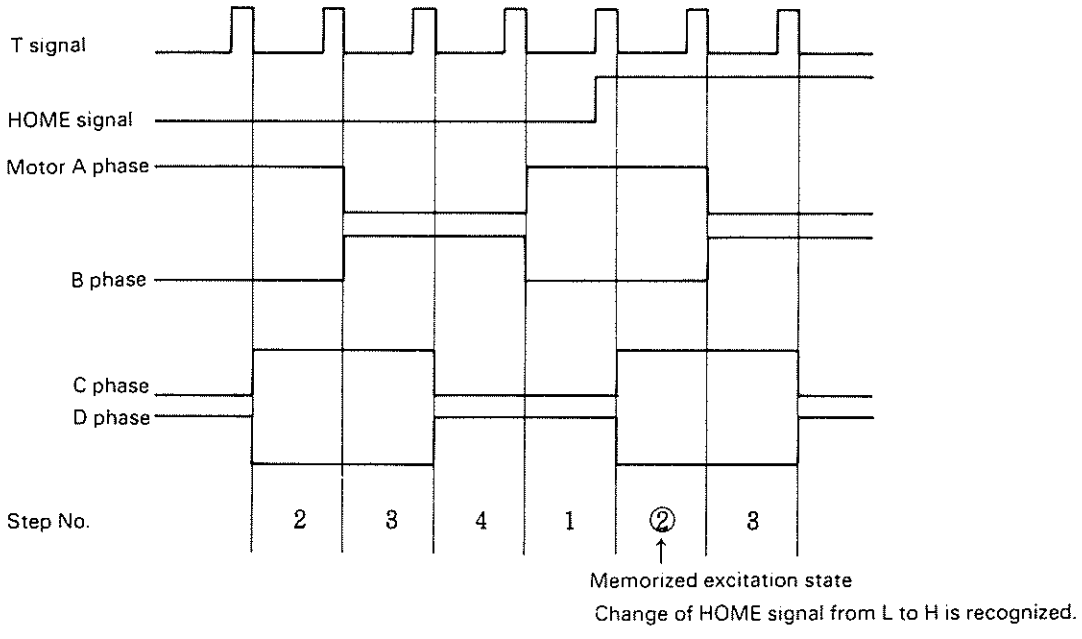


Fig. 2-29. Home Position Seek Timing

2.6.5 PAPER FEED CONTROL

The paper feed operation is controlled by the main CPU. The output of the predriver circuit (IC 2C) in the preceding stage is input to the paper feed IC (HA13007) to execute paper feed operation.

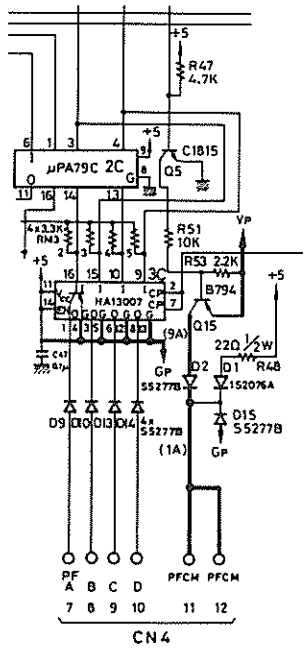


Fig. 2-30. Paper Feed Control Circuit

a) At power ON

In the paper feed motor, two phase coils are excited. At the same time, transistors Q5 and Q15 operate to supply a drive current for about 30 - 60 msec to fix the paper feed mechanism. After passage of about 30 - 60 msec, +5 V is supplied through resistor R48 and diode DI for coil excitation.

b) At operation

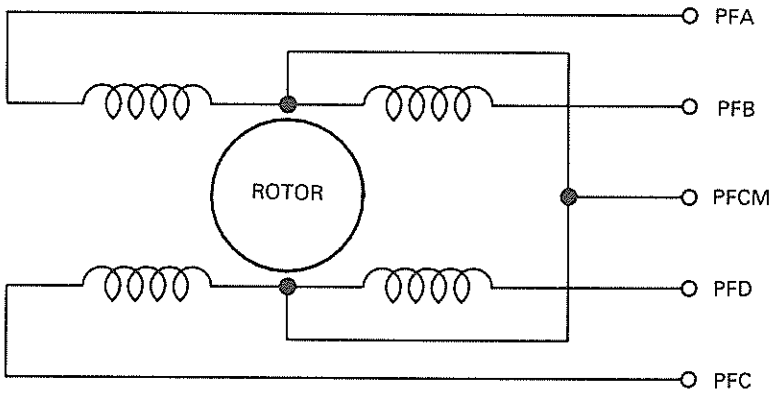
The paper feed motor is driven in the following manner: First, transistors Q5 and Q15 are turned ON by the PC2 signal from the main CPU to supply a drive current to the coils to be excited. Next, the paper feed operation is performed by the PC6 and PC7 signals from the main CPU.

c) At stop

Shift from paper feed mode to hold mode is performed after passage of 10 - 20 msec from the final phase selection. When the paper feed motor enters hold mode, a +5 V excitation current is supplied to the motor coils through resistor R48 and diode D16.

2.6.5.1 Print and Paper Feed Timing

In an alternate operation of print and then paper feed, the minimum time interval from paper feed start to print start is set to approx. 150 msec.



Coil impedance: 46 ohms + 7 % (at 25°C)

Fig. 2-31. Paper Feed Motor Connections

a) Paper feed in forward direction

Table 2-19. Paper Feed Motor Step Sequence (CW)

STEP No.	A phase	B phase	C phase	D phase
1	ON	OFF	ON	OFF
2	ON	OFF	OFF	ON
3	OFF	ON	ON	OFF
4	OFF	ON	OFF	ON

b) Paper feed in reverse direction

Table 2-20. Paper Feed Motor Step Sequence (CCW)

STEP No.	A phase	B phase	C phase	D phase
1	ON	OFF	OFF	ON
2	ON	OFF	ON	OFF
3	OFF	ON	ON	OFF
4	OFF	ON	OFF	ON

Paper feed pitch

0.12 mm (1/216")/one pulse
4.23 mm (1/6")/36 pulses
3.18 mm (1/8")/27 pulses
2.82 mm (1/9")/24 pulses

2.6.6 PRINT CONTROL

The head solenoid drive signals (PA7-PA0, PB7) from the main CPU are input to predrivers IC IB and 2C. When these input signals are LOW (normally HIGH to activate the predriver), the outputs of the predriver are cut off. When the predriver outputs are cut, voltage Vxp (+5) decreases the drive transistor base voltage, and the driver transistors (Q6 – Q14) turn on to activate the head solenoid. (Fig. 2-32)

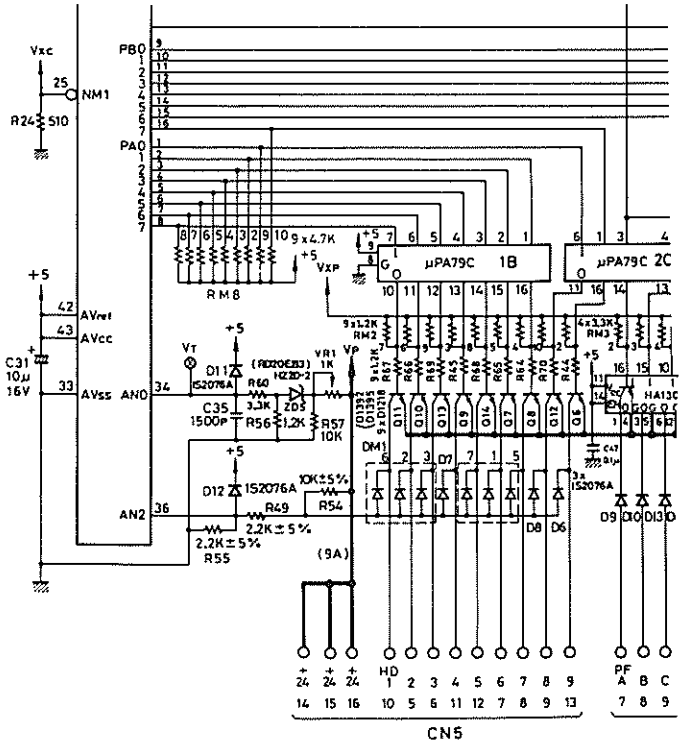


Fig. 2-32. Head Driver Circuit

2.6.6.1 Energization Timing

For the energization timing, the PTS signal which is generated when the carriage is operated, is input to PC5 of the main CPU. The main CPU outputs a LOW signal which has an energization pulse width.

2.6.6.2 Energizing Time Control (Fig. 2-33)

The energizing time is controlled according to reference voltage VT which is input to ANO of the main CPU. Reference voltage VT is normally factory-adjusted by VR1 to +2.5 V against +24 V of print solenoid applied voltage Vp. The energizing time is 400 μsec $\pm$ 10μsec +2.5 V of reference voltage VT. When print solenoid applied voltage Vp changes, reference voltage VT also varies. The ANO signal works to A/D convert this variation to control the energizing time.

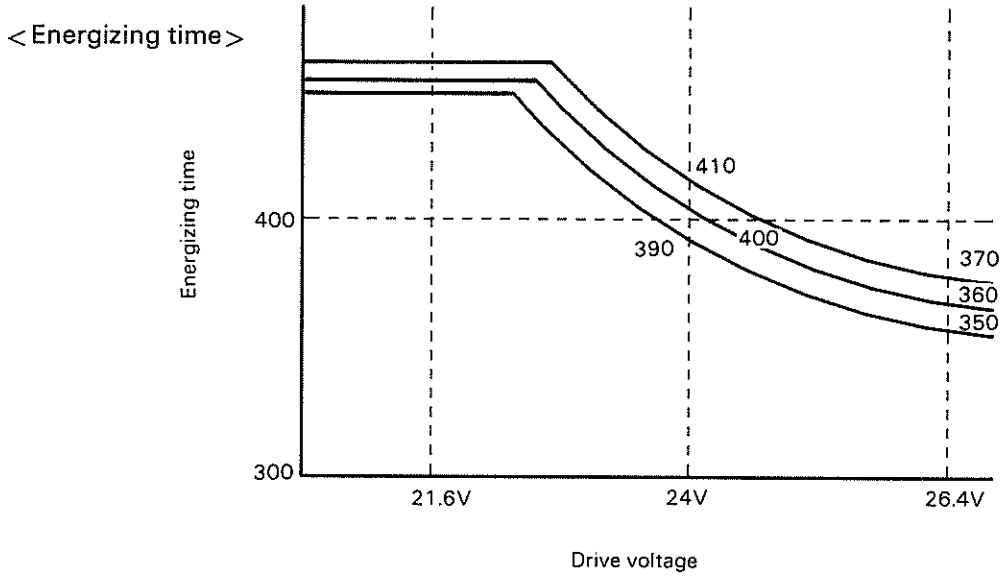


Fig. 2-33. Energizing Pulse Width

2.6.6.3 Print Solenoids (Print Head)

Number of solenoids	:	9
Driver applied voltage	:	21.6 - 26.4 V
Coil impedance	:	19.2 ohms $\pm$ 1.9 ohms (at 25°C)
Energizing time	:	390 - 410 μsec (at 24 V/25°C)

(1) Print Timing

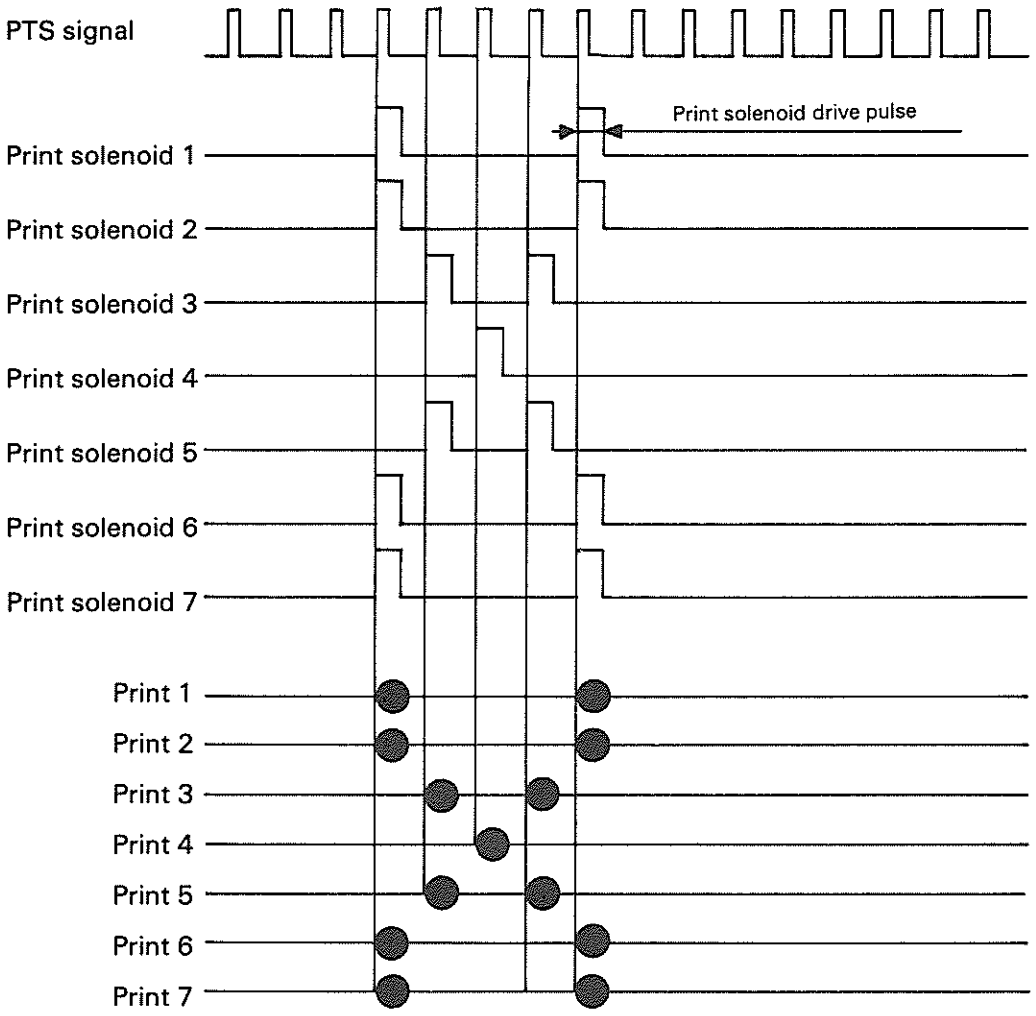


Fig. 2-34. Print Timing

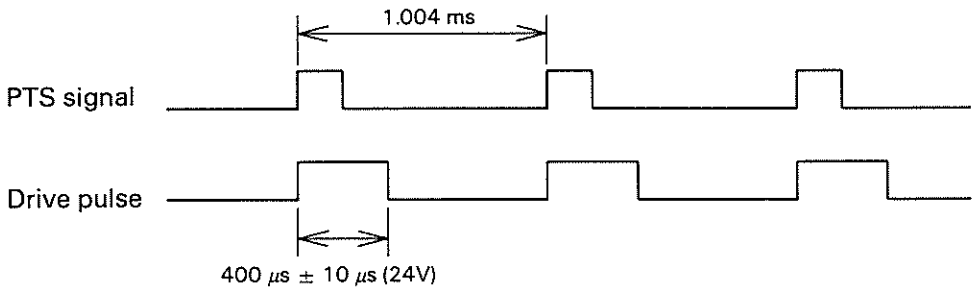


Fig. 2-35. PTS and Drive Pulse Timing

(2) Correspondence between dot wires and FPC

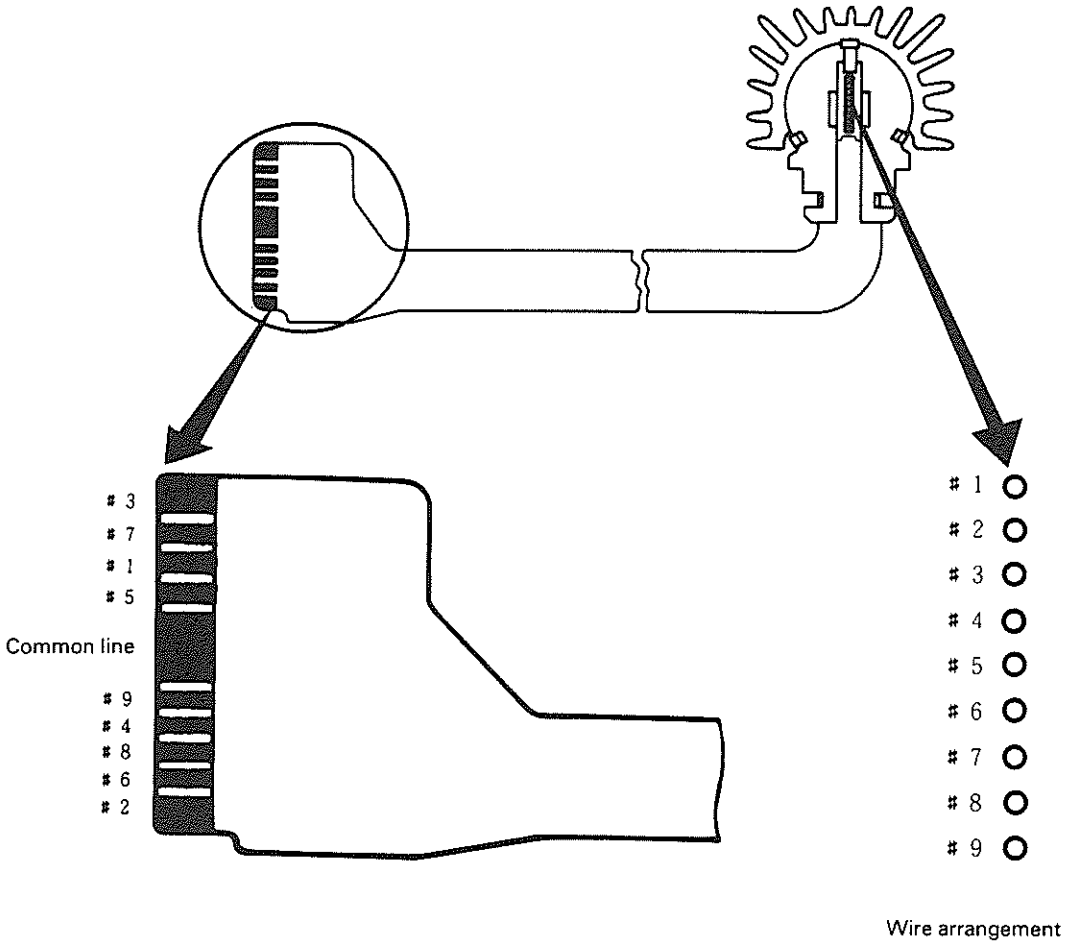


Fig. 2-36. Print Head

2.6.7 DETECTION MECHANISM

2.6.7.1 HP (Home Position) Sensor

1) Detection system: Photo-electric conversion

2) Output system: Open-collector

3) Circuit: See Fig. 2-37.

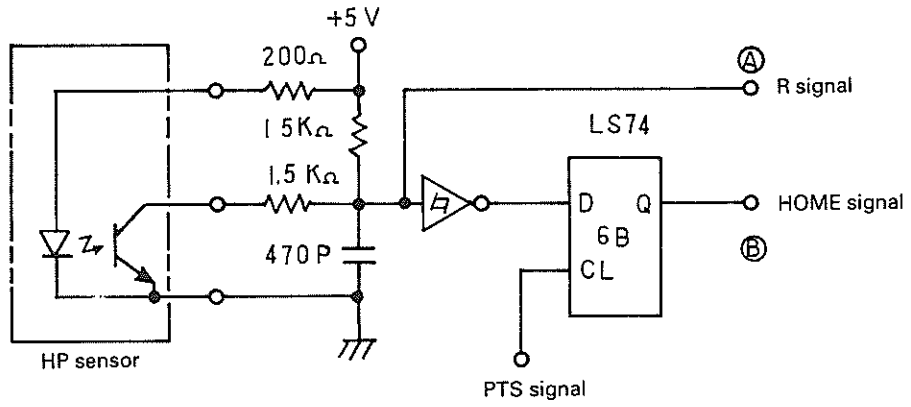


Fig. 2-37. HP Sensor Circuit

4) Operation: Change of the R signal from HIGH to LOW during driving of the carriage motor means that the carriage moves away from the home position. That signal is latched at IC 6B at the leading edge of the PTS signal and is indicated to the slave CPU.

5) Timing:

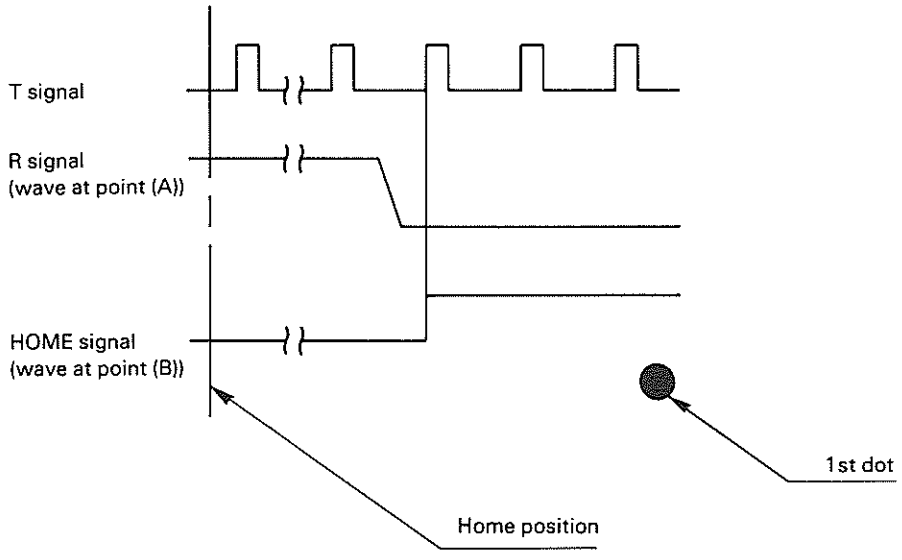


Fig. 2-38. First Dot Position

2.6.7.2 PTS (Print Timing Signal) Sensor

1) Detection system: Photo-electric conversion
2) Output system: TTL level
3) Circuit: See Fig. 2-39

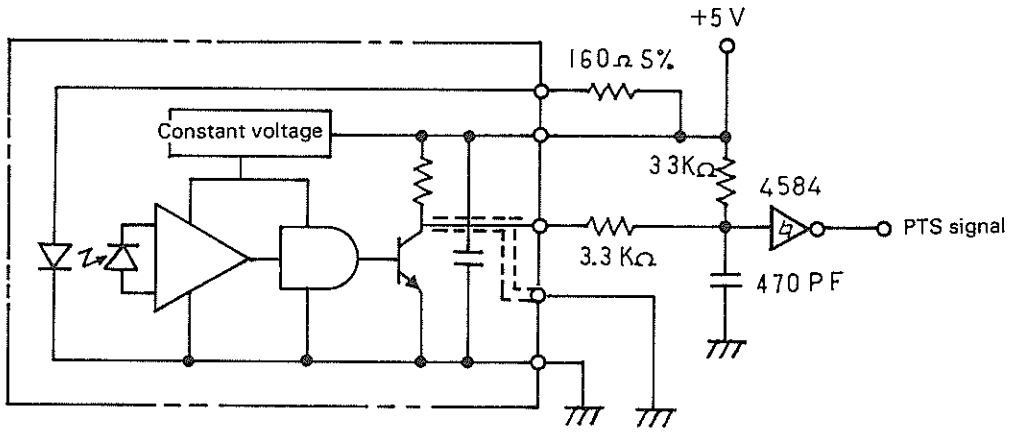


Fig. 2-39. PTS Sensor Circuit

4) Operation:

The sensor detects the light through the slit of the sensor plate under the carriage motor at the right side of the printer mechanism during operation of the carriage. The PTS signal, thus detected, is used as the reference of the following operations:

a. It is input to the slave CPU through IC 8A and IC 7C on the FXMB circuit board to correct the carriage speed.
b. It is input to the main CPU through IC 8A on the FXMB circuit board to determine the print timing.
c. It latches the status of the home position.

2.6.7.3 PE (Paper End) Sensor

1) Detection system: Reed switch

2) Switch rating: 10 - 50 mA, 5 VDC ± 5%

3) Switch mode: See Table 2-21

Table 2-21. Switch Mode

Paper	Switch Mode
Presence	OPEN
Absence	CLOSE

4) Operation: In case of the paper out detection is valid.
The paper end sensor is actuated when no paper remains. The condition of the interface signals when the paper end sensor is actuated is as follows: See Table 2-22.

Table 2-22. State of Interface Signals

Signal name	Connector CN1 Pin No.	Condition
$\overline{\text{ERROR}}$	32	Low
PE (paper end)	12	High
BUSY	11	High
$\overline{\text{ACKNLG}}$	10	No pulse is output

When the paper out condition occurs, the PAPER OUT indicator on the control panel lights and the mode is automatically switched to the off-line mode. Set new paper and press the ON LINE switch to make the printer to be ready to print.
In case of the paper out detection is invalid. The paper out indicator on the control panel lights up, but the mode does not change.

2.6.8 SERIAL CONTROL (Figs. 2-40 and 2-41)

The main CPU has a serial data control circuit inside to perform serial/parallel data conversion. The main CPU, which has a controllable serial data transfer capability of 9,600 bps, is provided with an external clock circuit of 614 kHz to obtain a higher transfer capability of up to 19,200 bps.

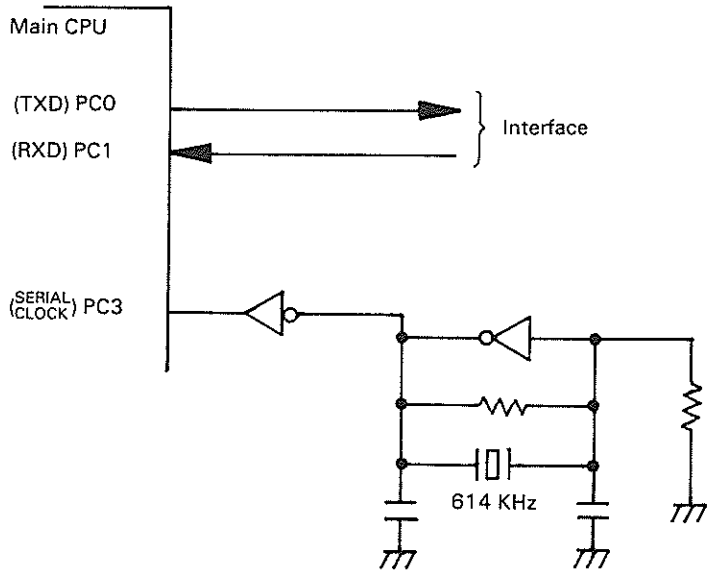


Fig. 2-40. Serial Control Circuit

(Serial interface configuration)

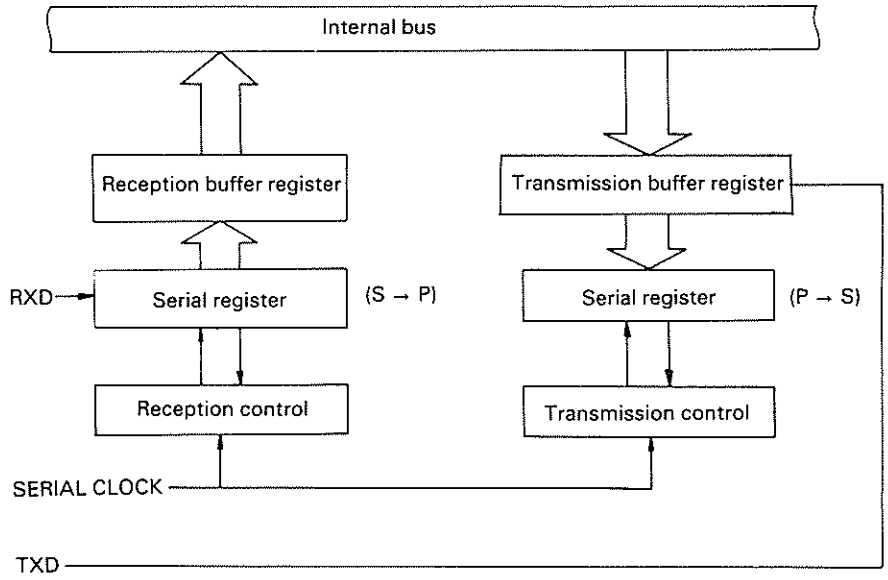


Fig. 2-41. Block Diagram for Serial Control

2.7 PRINTER MECHANISM

The Model-3510 and 3560 mechanisms are dot matrix printer mechanisms with sub-miniature heads developed for high quality, precision printing. Because the units come with tractor feed attachments and also are equipped with rubber plates, they may be used with continuous business forms or rolled or cut sheet paper, as required by the user. No special additional equipment need be purchased to accommodate the various paper types. Basic operation of both models (Figs. 2-42 and 2-43) is essentially the same.

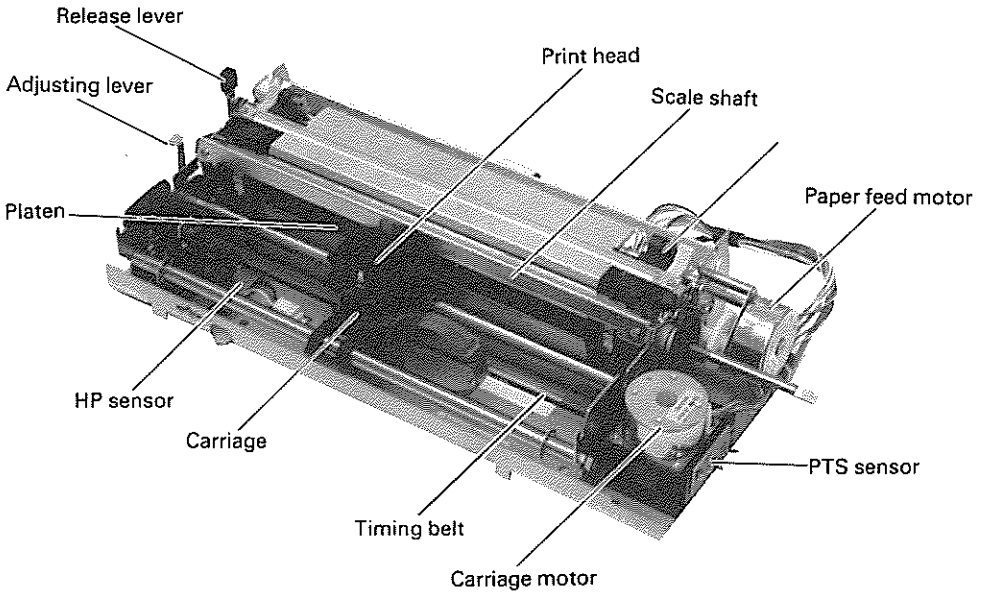


Fig. 2-42. Exterior View of Model-3510 Printer Mechanism (FX-80+/FX-85)

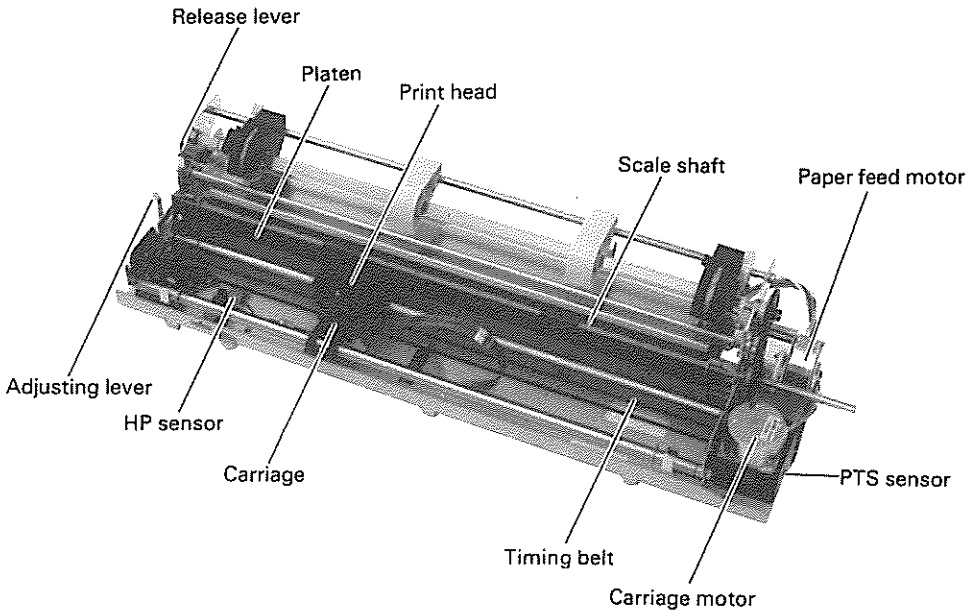


Fig. 2-43. Exterior View of Model-3560 Printer Mechanism (FX-100+/FX-185/105)

2.7.1 SENSOR MECHANISMS (M-3510/3560 Signal Generating Mechanism)

Sensor mechanisms on both models include the home position (HP), print timing (PTS), and the paper end (PE) sensors.

2.7.1.1 Home Position (HP) Sensor

The HP sensor assembly consists of a HP sensor and a sensor plate, situated beneath the carriage assembly. The sensor emits a HIGH signal whenever the senser plate intercepts the optical axis of the photo sensor. The variations in the signal alert the main CPU as to when the carriage is in or out of the home position (i.e., the left end of the platen). This signal serves as a reference signal for the printing operation.

2.7.1.2 Print Timing Sensor (PTS)

The PTS sensor mechanism consists of the sensor and a sensor disk, located on the shaft of the carriage motor. The PTS signal is generated in order to coordinate carriage speed with firing of the dot wires, allowing adequate time for the print operation to be performed.
A HIGH signal is emitted as the slits in the disk pass the optical axis of the photosensor.

2.7.1.3 Paper End (PE) Sensor

The PE sensor consists of a reed switch mounted on the PE sensor board and a reed magnet mounted on a PE sensor lever. The assembly is attached at the rear of the printer mechanism. When the printer runs out of paper, the reed magnet and reed switch meet, causing the PE warning signal to be output.

2.7.2 PRINT ASSEMBLY

The print assembly is comprised of the carriage assembly, including the carriage motor, timing belt, and platen; and the printhead, which is mounted on the carriage assembly.

2.7.2.1 Carriage Assembly

The carriage assembly is moved back and forth along the carriage shafts by the timing belt, which is driven by the carriage motor via the belt driven pulley (Figure 2-44)

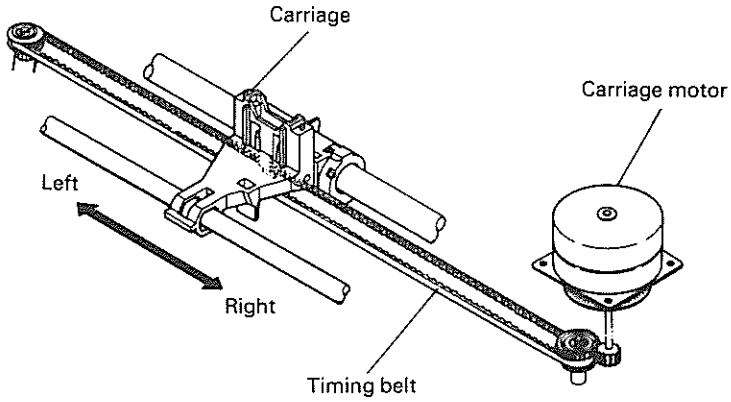


Fig. 2-44. Carriage Mechanism

The carriage motor is a 2 - 2 phase stepper motor.
The timing belt drive sequence is demonstrated in Table 2-23

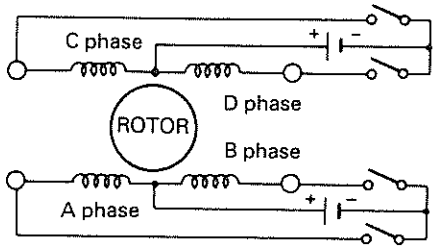


Fig. 2-45. Carriage Motor Connections

The carriage motor drive sequence for carriage motion is as follows:

Table 2-23. Carriage Motor Step Sequence

Carriage Motion	Step No.	A phase	B phase	C phase	D phase
Left → right	1	ON	OFF	OFF	ON
	2	ON	OFF	ON	OFF
	3	OFF	ON	ON	OFF
	4	OFF	ON	OFF	ON
Right → left	1	ON	OFF	ON	OFF
	2	ON	OFF	OFF	ON
	3	OFF	ON	OFF	ON
	4	OFF	ON	ON	OFF

As the carriage motor rotates, PTS pulses are generated, energizing the head driving coils, which in turn fire the dot wires housed in the print head.

2.7.2.2 Printing Operation

When the head driving coil for a dot wire is energized, the actuating plate engaged at one end of the dot wire is attracted to the iron core, driving the dot wire toward the platen. The dot wire, thus driven, strikes the ribbon, pressing it against the paper in the platen assembly, and causing a dto to be imprinted.

When the head driving coil is de-energized, the actuating plate spring recoils, causing the actuating plate to spring back to it's original position. The dot wire also springs back under the combined force of impact energy and the recoil of the wire resetting spring, and is again engaged with the actuating plate until the next print head drive signal occurs, Firing of a dot wire is depicted in Figure 2-46.

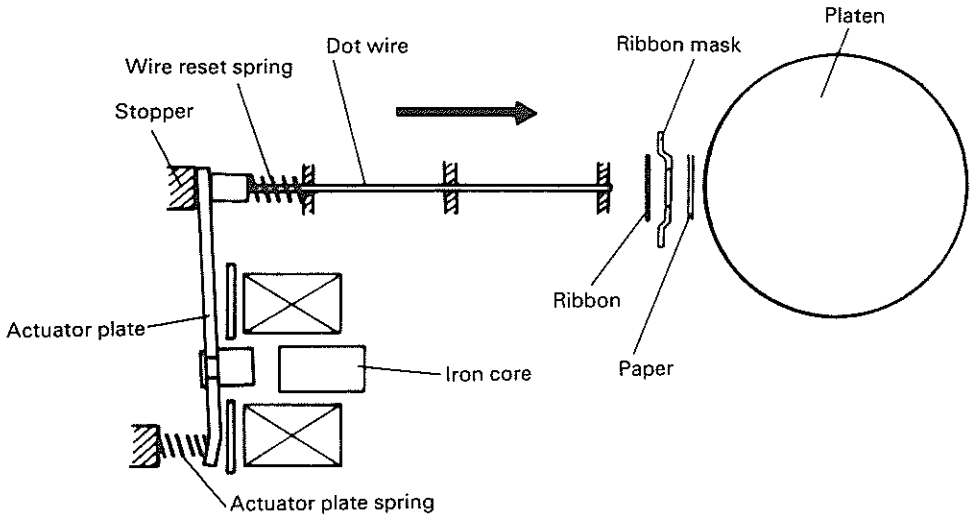


Fig. 2-46. Print Mechanism

2.7.3 PAPER FEED MECHANISM

The Model-3510/3560 mechanisms are adaptable for use with different paper types. The Model-3510 has three paper feed options: friction, pin platen, or sprocket feed, and utilizes three paper types: roll, cut sheet, or continuous business forms.

The Model-3560 operates with both friction and sprocket feed, and may be used with continuous business forms or cut sheet paper.

2.7.3.1 Friction Feed System (For Roll or Cut Sheet Paper)

The friction feed system permits use of roll (Model-3510 only) or cut sheet paper, which is fed through the platen assembly between the paper feeding and paper holding rollers.

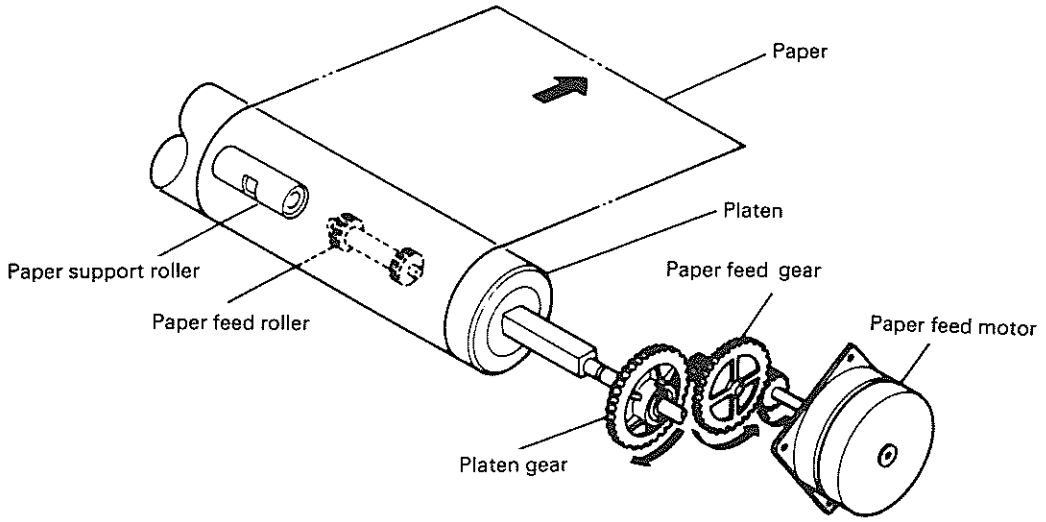


Fig. 2-47. Friction Feed Mechanism

2.7.3.2 Pin Platen Feed System (For Continuous Business Forms 9.5 and 10 Inches in Width/Model-3510 only)

In the pin platen feed system, paper is held in place on platen sprocket pins on the platen shaft. When the paper feed pulse motor rotates, the platen gear train is driven, rotating the gears as illustrated in Figure 2-48, and pulling the paper along on the sprocket pins.

When the pin platen feed system is used, the paper feed rollers are held apart by the release lever, since no friction is required for movement of the paper.

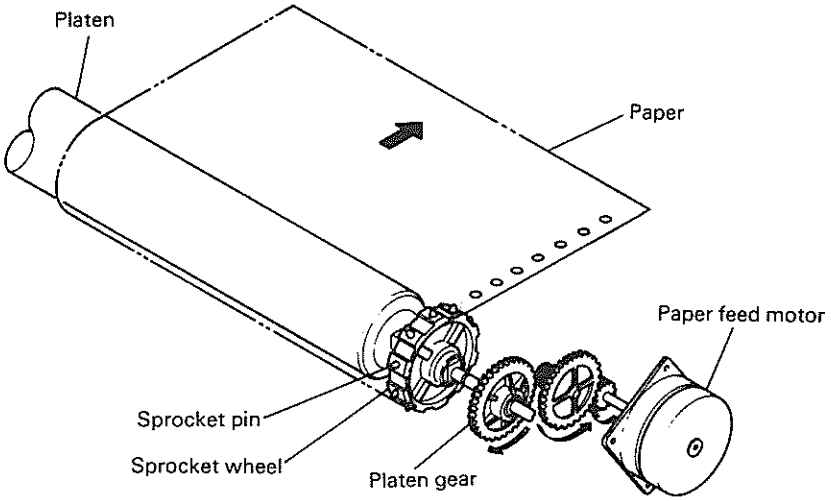


Fig. 2-48. Pin Platen Feed Mechanism

2.7.3.3 Sprocket Feed System (For Continuous Business Forms)

Similar to the pin platen feed operation, in the sprocket feed system, perforations on the paper margins are fitted over the pins on the sprocket wheel. The paper is locked into place by a paper holding cover, and is drawn through the platen assembly as the gear train is activated by the paper feed motor (Fig. 2-49).

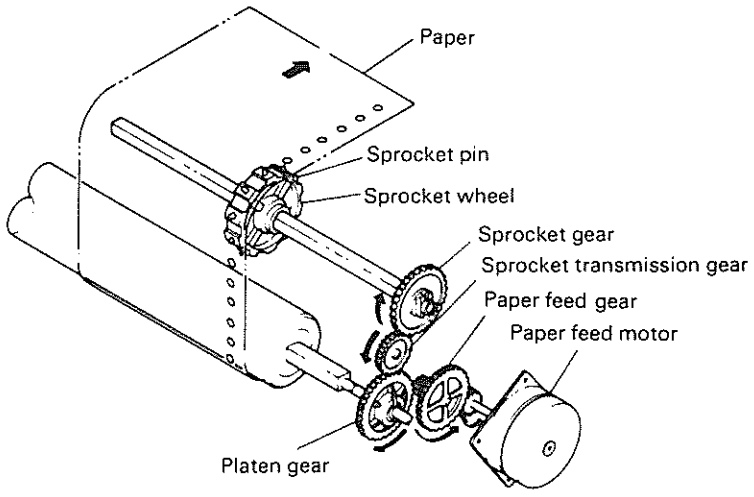


Fig. 2-49. Sprocket Feed Mechanism

2.7.4 RIBBON FEED MECHANISM

The ribbon feed unit of the 3510/3560 mechanism (Fig. 2-50) consists of a cartridge ribbon and a ribbon feeding mechanism which is set on a belt tension plate assembly. The right or left motion of the timing belt is transmitted to the ribbon drive gear through the gears on the belt tension plate. Due to conformation of the gear train, the ribbon is always fed in a conter clock wise direction.

When the ribbon feed roller is driven by the ribbon drive gear, the continuous loop, inked ribbon is wound between the ribbon feed roller and the ribbon support roller. The ribbon brake spring is set at the exit of the cartidge case to prevent slack as the ribbon is wound in.

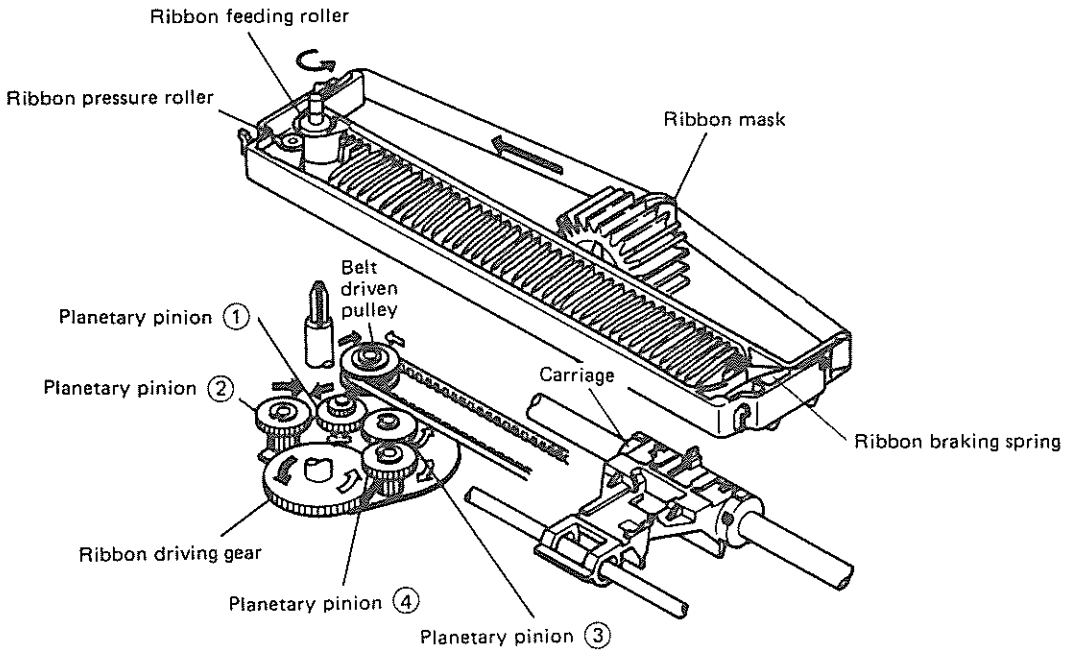


Fig. 2-50. Ribbon Feed Mechanism

CHAPTER 3
OPTIONAL EQUIPMENTS

LIST OF FIGURES

LIST OF TABLES

3.1 CUT SHEET FEEDER

The cut sheet feeder (CSF) has been designed in four different models in order to accommodate several different printers. While this text references only one model, the operating principles of each of the four models listed in the table below are essentially the same.

Each unit is controlled by printer firmware, requires no electrical interface, and features high reliability and easy installation.

CSF models are compatible with EPSON printer models as detailed in table.

Table 3-1. CSF Printer Application

OPTION NO.	APPLICATION
8330	RX-80F/T+
8331	FX-80+/FX-85
8332	RX-100+
8333	FX-100+/FX-185(105)

Fig. 3-1, following, illustrate Cut Sheet Feeders for the RX-80F/T+ and FX-80+/FX-85 printers and the RX-100+/FX-185(105) and FX-100+ printers.

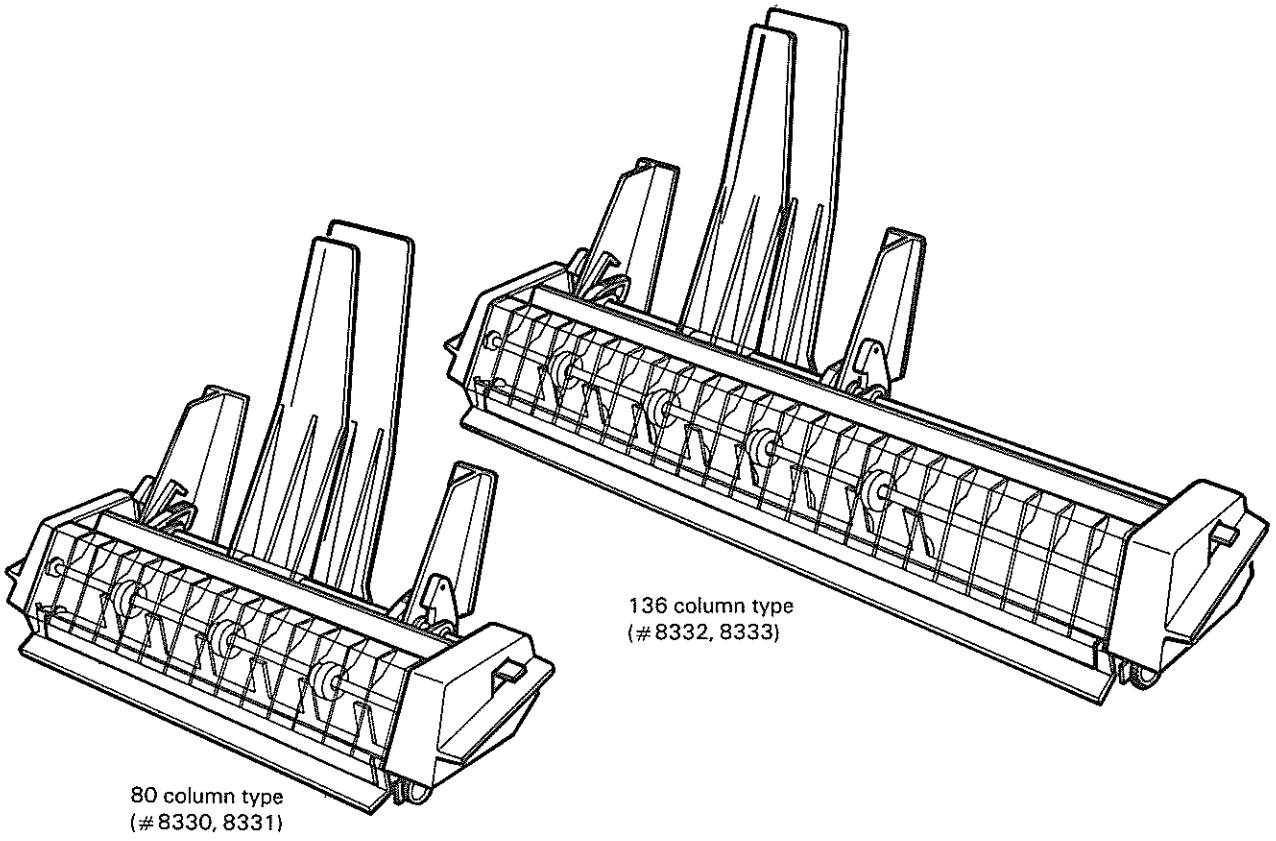


Fig. 3-1. Cut Sheet Feeders

3.1.1 SPECIFICATIONS

Cut Sheet Feeder

Dimensions and Weight

	#8330	#8331	#8332	#8333
Height (mm)	255	255	255	255
Depth (mm)	173	173	173	173
Width (mm)	357	357	532	532
Weight (kg)	1.3	1.3	1.7	1.7

Printer Application

- #8330 ..... RX-80 F/T+
- #8331 ..... FX-80+/FX-85
- #8332 ..... RX-100+
- #8333 ..... FX-100+/FX-185(105)

Input Stacker Capacity ..... 80 sheets (70 kg)

Stacker Capacity ..... 80 sheets (70 kg)

Ambient Conditions

Temperature

- Operating ..... 5°C – 35°C (within 8°C/h)
- Non-operating ..... –30°C – +65°C

Humidity

- Operating ..... 15% – 80% (no condensation)
- Non-operating ..... 5% – 95% (no condensation)

Reliability

- MCBF (Mean Cycle Between Failure) 187,500 cycles
- MTBF (Mean Time Between Failure) . 5000 hours (assumes Approx 300 Sheet 18 hours)

Paper

Length

- minimum ..... 210 mm (8.25")
- maximum ..... 306 mm (12.")

Width

- #8330, #8331, #8332 ..... 7.25" – 8.5"
- #8333 ..... 7.25" – 12."

Quality

- Thickness ..... Best refined paper/finished surface 64 g/m² – 82 g/m²
- Tolerance ..... Less than 3° Within 0.5 mm (0.020") Corners at exact right angles

Storage Conditions

- Temperature ..... +18°C ~ +22°C
- Humidity ..... 40% ~ 60%

Caution: Use only perfectly processed, cut and finished paper.
Do not use paper which has been folded.
Do not use a sheet of paper more than once.

3.1.2 DIFFERENCE BETWEEN #8330/8332 and #8331/8333

Following figures show the difference between #8330/8332 and #8331/8333.
Although they differ in appearance and feed mechanism, their mechanical function is identical.

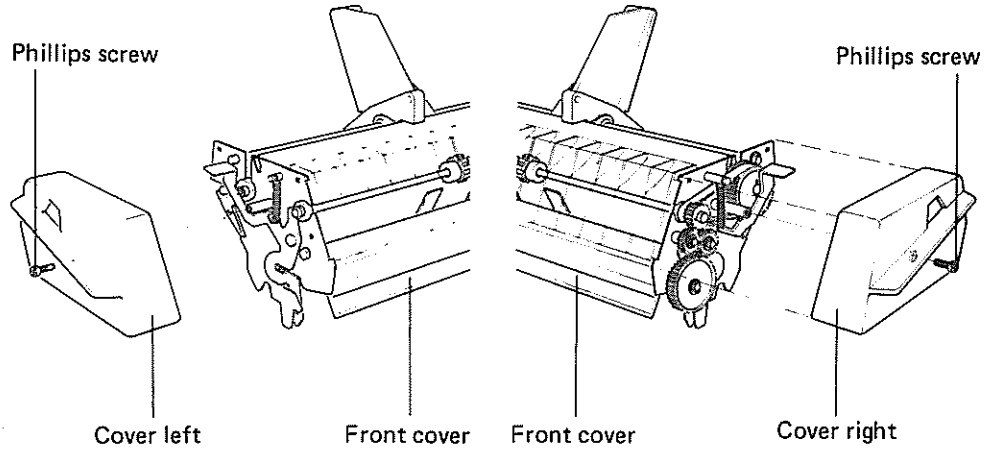


Fig. 3-2. #8330/8332 Cut Sheet Feeder

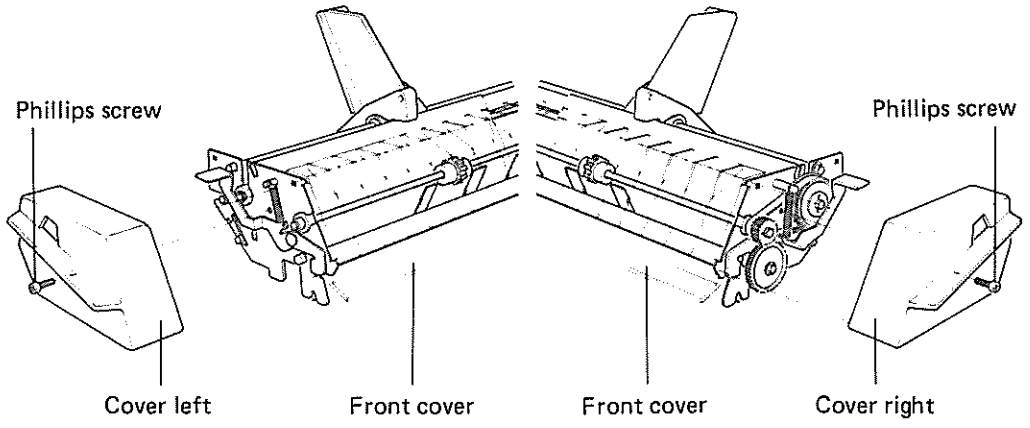


Fig. 3-3. #8331/8333 Cut Sheet Feeder

3.1.3 PRINTER SETTINGS

When the cut sheet feeder is to be used, the following DIP switch setting must be needed.

(1) Case of the RX-80F/T+, RX-100+ (See Table 3-2.)

In case of the RX plus series, DIP switch 1-3 must be selected.

Table 3-2. Functions and Conditions of DIP Switches No. 1 and No. 2 (RX Series)

SW Pin	Function	OFF	ON	Factory-Set Condition
1-1	Selects Pica-size or Condensed mode.	Pica-size	Condensed	OFF
1-2	Sets control codes (128)D through (159)D as graphic symbols.	Control code	Graphic symbol	OFF
1-3	**Cut Sheet Feeder Mode**	Normal	CSF mode	OFF
1-4	Form length	11-inch	12-inch	OFF
1-5	Paper-end detector	Valid	Invalid	OFF
1-6	International character set	–		–
1-7	International character set			
1-8	International character set			
2-1	ZERO font	0	ϕ	OFF
2-2	$\overline{\text{SLCT IN}}$ signal internally fixed or not fixed	Not fixed	Fixed	ON
2-3	Automatic line feed ($\overline{\text{AUTO FEED XT}}$)	LF must be from host	Auto LF with CR	OFF
2-4	1 inch skip-over perforation	Invalid	Valid	OFF

(2) Case of the FX-80+/100+and FX-85/185/105 (See Table 3-3.)

In case of the FX-80+/100+ and FX-85/185/105, DIP switch 2-2 must be selected.

Table 3-3. Functions and Conditions of DIP Switches No. 1 and No. 2 (FX Series)

SW Pin	Function	OFF	ON	Factory-Set Condition
1-1	Print mode at POWER ON	Pica-size	Condensed	OFF
1-2	ZERO font	0	ϕ	OFF
1-3	Paper-end detector	Valid	Invalid	OFF
1-4	Input buffer (FX-80+/100+)	Invalid	Valid	ON
	Character mode (FX-85/185/105)	IBM mode	ESC/P mode	
1-5	Print mode at POWER ON	Pica-sized	Emphasized	OFF
1-6	International character set	–		–
1-7	International character set			
1-8	International character set			
2-1	$\overline{\text{SLCT IN}}$ signal internally fixed or not fixed	Not fixed	Fixed	ON
2-2	**Cut Sheet Feeder Mode**	Normal	CSF mode	OFF
2-3	1 inch skip-over perforation	Invalid	Valid	OFF
2-4	Automatic line feed ($\overline{\text{AUTO FEED XT}}$)	LF must be from host	Auto LF with CR	OFF

3.1.4 PRINCIPLES OF OPERATION

When the cut sheet feeder is to be used, the CSF mode must be set in order to instruct the printer to perform paper feed and skip over perforation operations. CSF mode setting may be selected either by DIP switch setting or by input of the ESC EM control code. When CSF is enabled, single sheet paper is automatically fed through the paper bin when print on the previous page has been nearly completed.

3.1.4.1 Control Code Setting

To set the CSF mode using the ESC sequence, refer to the following:

Name:	ESC EM (Sets CSF)
Format:	CHR$ (27); CHR$ (25); "n"
	(n = 0 or 4)
Function:	n = 0 CSF function enabled
	n = 4 CSF function disabled

Following control codes are affected when the CSF mode has been set: FF, LF, VT, ESCJ, ESC f1 + m

3.1.4.2 Paper End Status in CSF Mode

In the CSF mode, the paper end detector on the printer mechanism does not reflect an error state when the PE control panel LED is on. The printer enters the error state only when no paper is loaded into the printer mechanism even though a load command has been issued.

When paper is properly loaded, the error state can be cancelled and the load function reinstated by depressing the ON-Line switch.

3.1.5 DISASSEMBLY/ASSEMBLY PROCEDURES

In this section, disassembly/assembly procedures for the cut sheet feeder are detailed. Once a faulty component has been identified via trouble shooting techniques, refer to the disassembly/assembly section, following for proper repair/replacement procedures.

Since reassembly procedures are the exact opposite of disassembly, except as specifically noted, reassembly should be performed by reversing the disassembly procedure.

Caution: Before beginning any disassembly/repair procedures, remove the cut sheet feeder from the printer.

3.1.5.1 Dismountion the Cut Sheet Feeder

Step 1: Remove paper if paper bin has been loaded.

Step 2: While holding the right and left handles, depress the lock levers.

Step 3: Lift up on the unit to remove it from the printer.

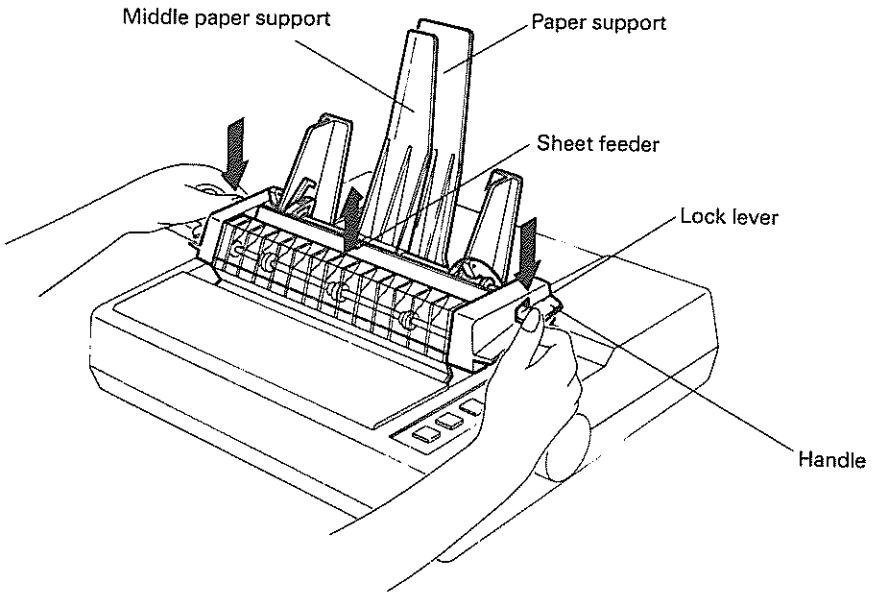


Fig. 3-4. Cut Sheet Feeder Removal

3.1.5.2 Removing the End Covers

Step 1: Remove the paper supports. (See Fig. 3-4.)

Step 2: Using a phillips screwdriver, remove the two screws that secure the left and/or right cover.

Step 3: Lift the cover (s) away from the unit.

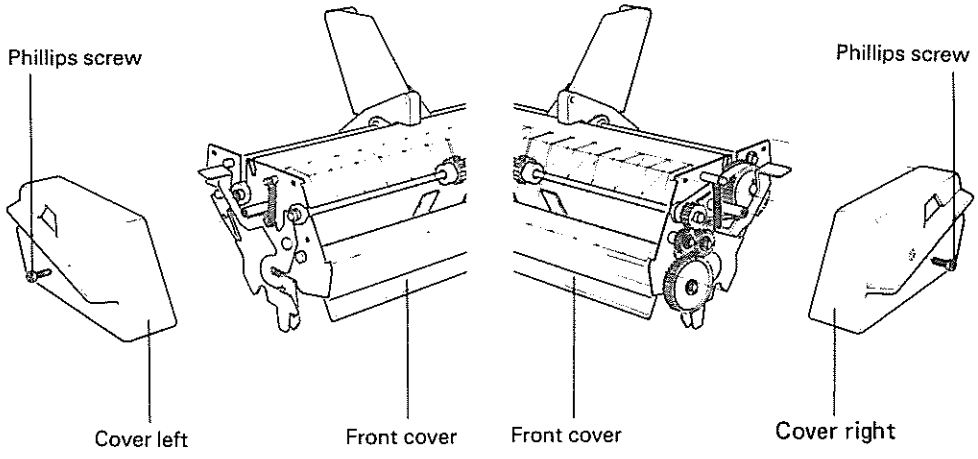


Fig. 3-5. End Cover Removal

3.1.5.3 Disassembling Toothed Belt and Pinion

Step 1: Refer to section 3.1.5.1 and dismount the cut sheet feeder.
Step 2: Refer to sections 3.1.5.2 and remove the end plates.
Step 3: Remove the C-Clip from the left end of the profile rubber shaft.
Step 4: Press the end of the profile rubber shaft toward the gear train until the pin clears the gear.
Step 5: Remove the pin.
Step 6: Remove the pinion from the profile rubber shaft.
Step 7: Replace the pinion or toothed pinion belt as required.

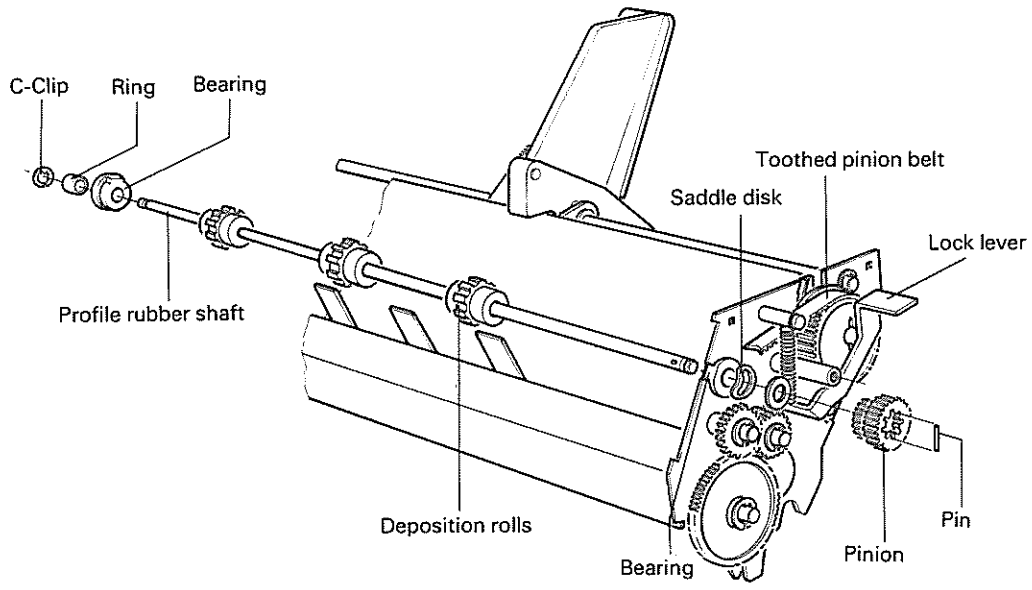


Fig. 3-6. Disassembling Toothed Belt and Pinion

NOTE: During disassembly (2) bearings spring pins may also be removed from profile rubber shaft. Be sure that they are correctly replaced during the reassembly process.

3.1.5.4 Rubber Profile Shaft Disassembly

Step 1: Refer to section 3.1.5.3 and perform steps 1-7.
Step 2: Remove rubber shaft from left and right bearings and away from the CSF frame.

NOTE: When reassembling the unit, be sure that each deposition roll is centered between two deflector plates.

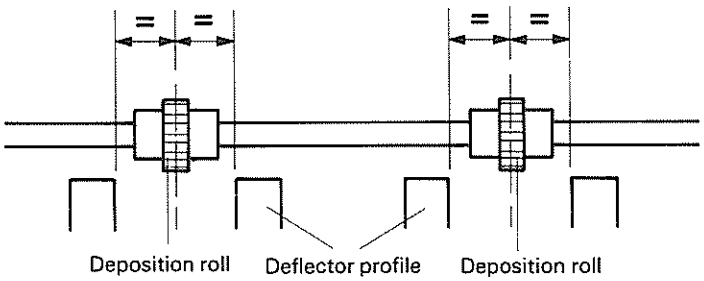


Fig. 3.-7. Rubber Profile Shaft Position

3.1.5.5 Belt Pulley Removal

Step 1: Refer to section 3.1.5.3 and perform steps 1-2.

Step 2: Remove the C-Clip from the left end of the drive shaft.

Step 3: Press the drive shaft in ward toward the gear train until the pin extrudes from the center of the belt pulley.

Step 4: Remove the pin.

Step 5: Remove the belt pulley from the drive shaft. Be sure that the saddle disk remains on the shaft.

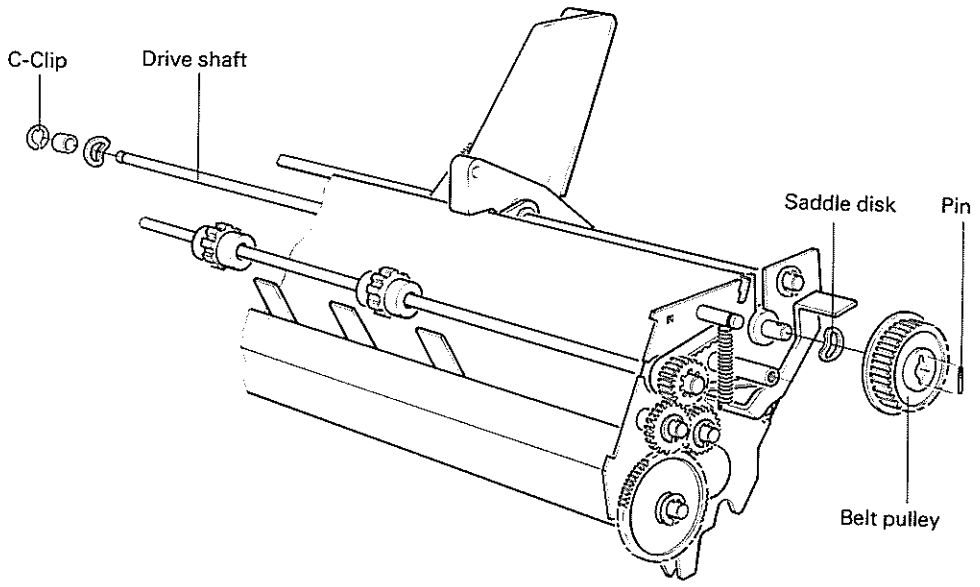


Fig. 3-8. Belt Pulley Removal

NOTE: Make sure that the bearings are inserted properly when reassembling the unit.

3.1.5.6 Removing the Drive Shaft and Rubber Rolls

Step 1: Refer to section 3.1.5.5 and perform steps 1 through 5.

Step 2: Loosen the V-profile lock screw from the right side plate.

Step 3: Place the CSF assembly face down and press the V-profile to the left and lift out.

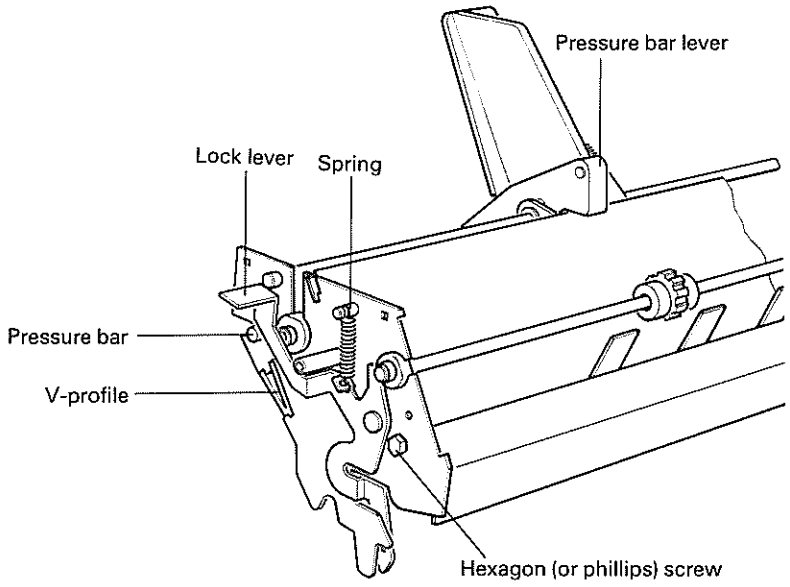


Fig. 3-9. Drive Shaft and Rubber Rolls Removal (A)

Step 4: Depress both pressure bar levers and remove the pressure bar.

Step 5: Detach the spring between the peg on the left side plate and the lock lever.

Step 6: Remove the hexagon or phillips screw that secures the left side plate.

Step 7: Remove the left end of the drive shaft.

Step 8: Slide the rubber roller from the shaft.

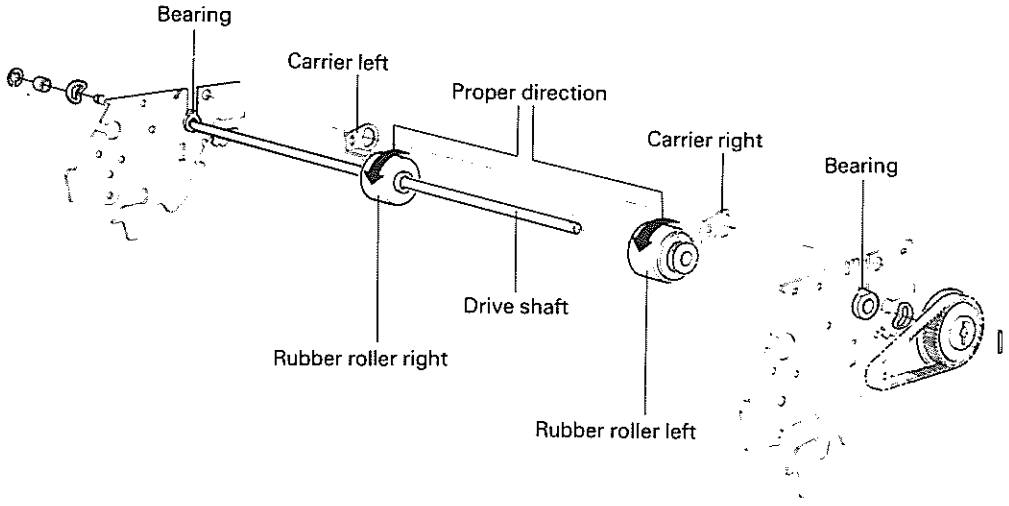


Fig. 3-10. Drive Shaft and Rubber Rolls Removal (B)

3.1.5.7 Paper Guide Removal

Step 1: Refer to section 3.1.5.6 and perform steps 1-4.

Step 2: Remove two C-Clips from left end of the shaft.

Step 3: Lift the shaft, with paper guides attached, away from the left and right plates.

Step 4: Slide the paper guide assembly (left and/or right) from the shaft as required for replacement.

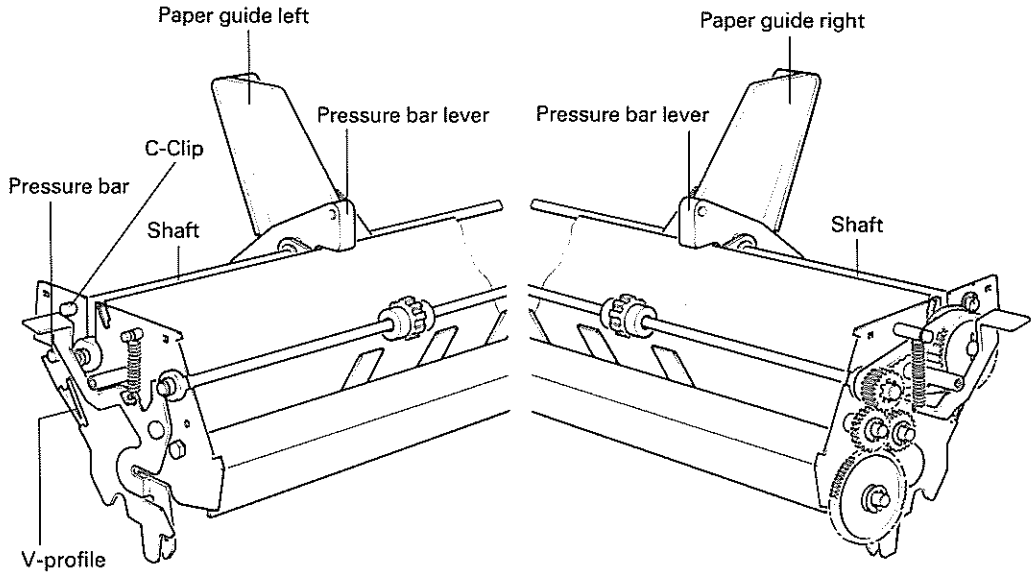


Fig. 3-11. Paper Guide Removal (A)

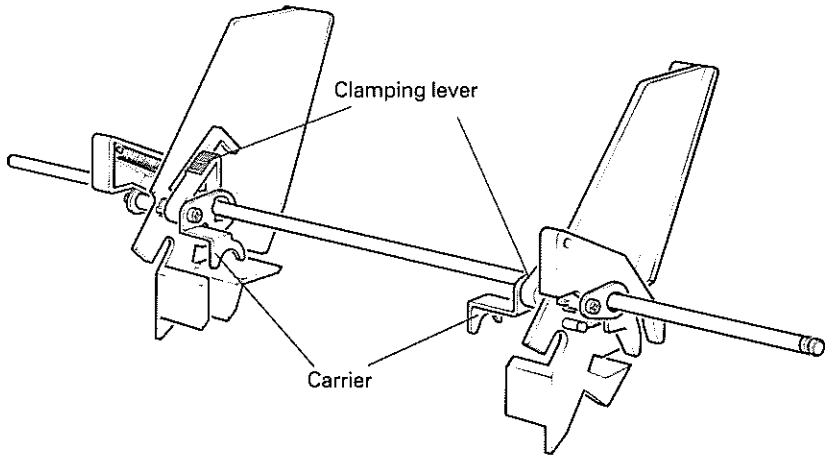


Fig. 3-12. Paper Guide Removal (B)

3.1.5.8 Disassembly The Carrier or Clamping Lever

Step 1: Refer to section 3.1.5.7 and perform steps 1 – 4.

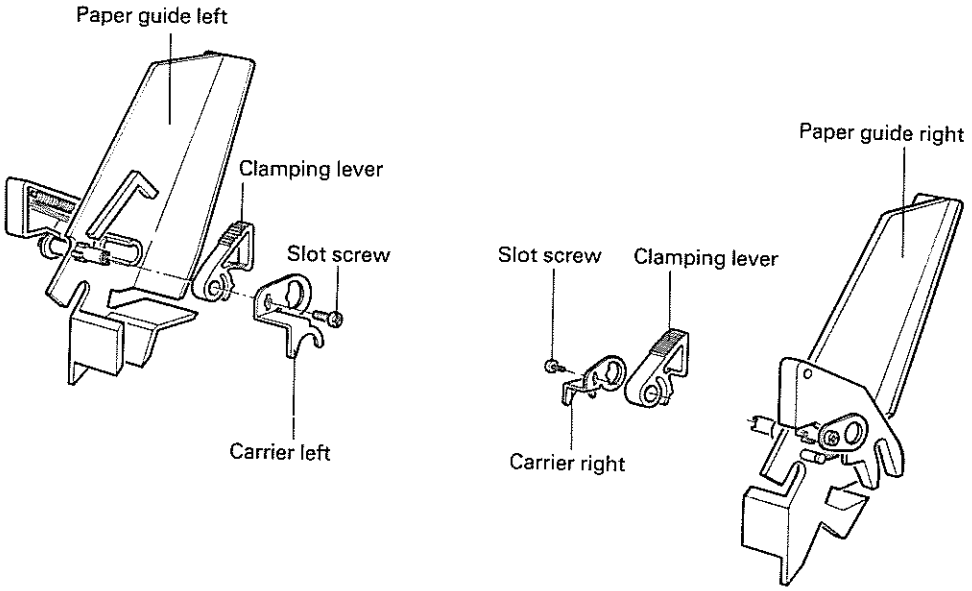


Fig. 3-13. Carrier and Clamping Lever Removal

Step 2: Remove the slotted screw from the appropriate paper guide left or right.

Step 3: Remove the carrier and clamping lever.

3.1.5.9 Disassembly the Pressure Bar Lever or Tension Spring

Step 1: Refer to section 3.1.5.7 and perform steps 1 – 4.

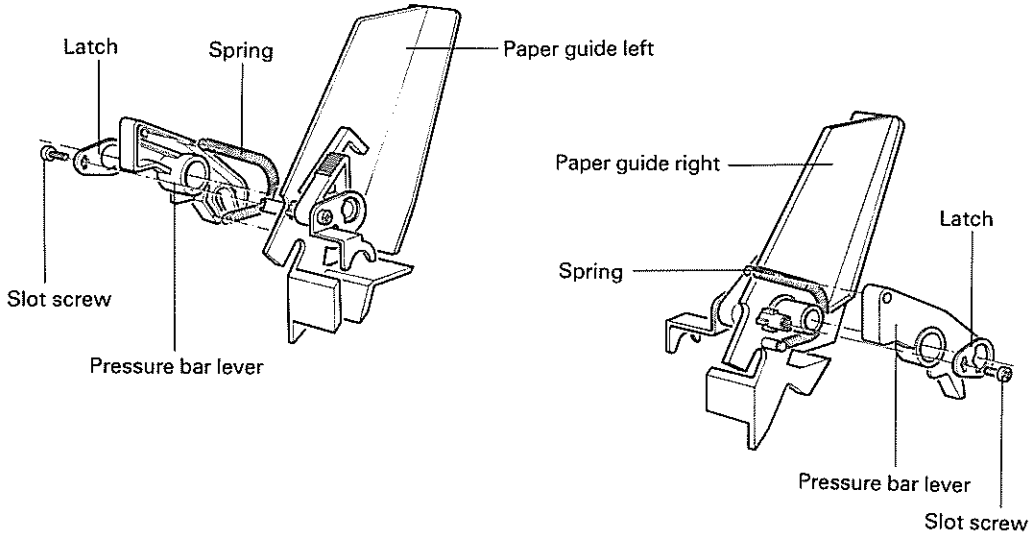


Fig. 3-14. Pressure Bar Lever and Tension Spring Removal

Step 2: Remove the slotted screw from the appropriate paper guide left or right.

Step 3: Remove the pressure bar lever and detach the tension spring from the peg inside the pressure bar lever.

3.1.5.10 Removing the Left Side Plate

Step 1: Refer to section 3.1.5.3 and perform steps 1 – 3.
Step 2: Remove the ring and left bearing from the rubber profile shaft.
Step 3: Depress both pressure bar levers and remove the pressure bar.
Step 4: Remove the C-Clip from the left end of the shaft.
Step 5: Remove the drive shaft C-Clip.
Step 6: Remove the ring and left bearing from the drive shaft.
Step 7: Detach the spring between the peg on the left plate and to lock lever.
Step 8: Remove the hexagonal or phillips screw from the left side palte.
Step 9: Remove the left side plate.

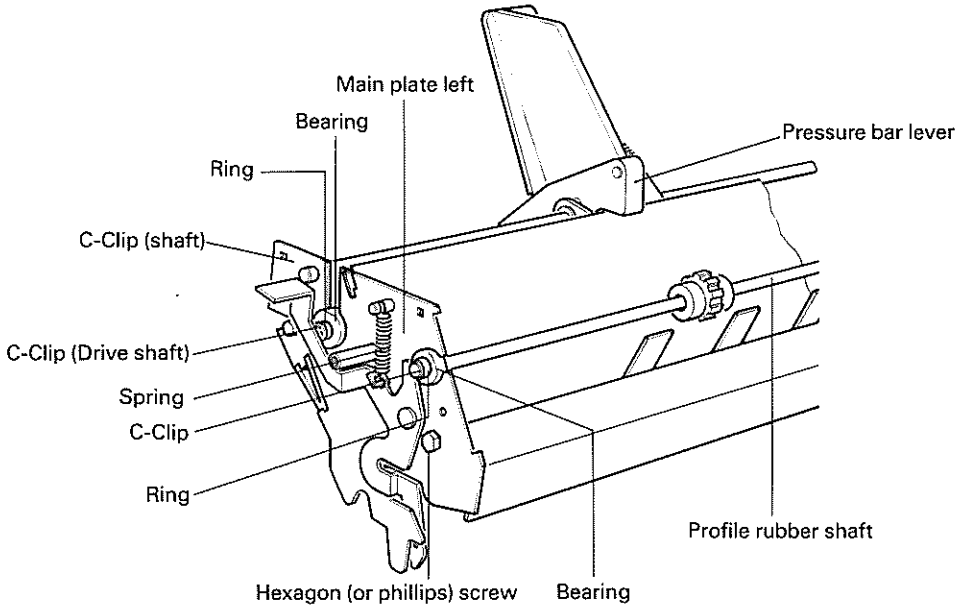


Fig. 3-15. Left Side Plate Removal

3.1.5.11 Removing the Right Side Plate (#8330, #8332)

Step 1: Refer to section 3.1.5.3 and perform steps 1 – 6.
Step 2: Remove bearing on the right side plate.
Step 3: Remove the C-Clip from the gear wheel.
Step 4: Remove the gear wheel.
Step 5: Refer to section 3.1.5.5 and perform Step 2-4.
Step 6: Remove the belt pulley from the drive shaft.
Step 7: Detach the spring between the peg on the right side plate and the lock lever.
Stip 8: Remove the hexagon or phillips screw from the right side plate.
Step 9: Remove the right side plate.

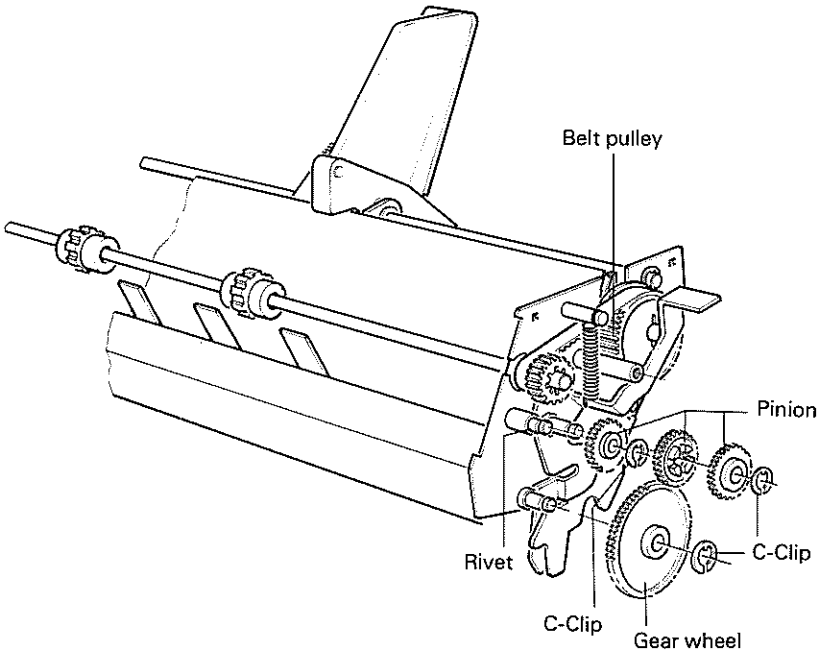


Fig. 3-16. Right Side Plate Removal

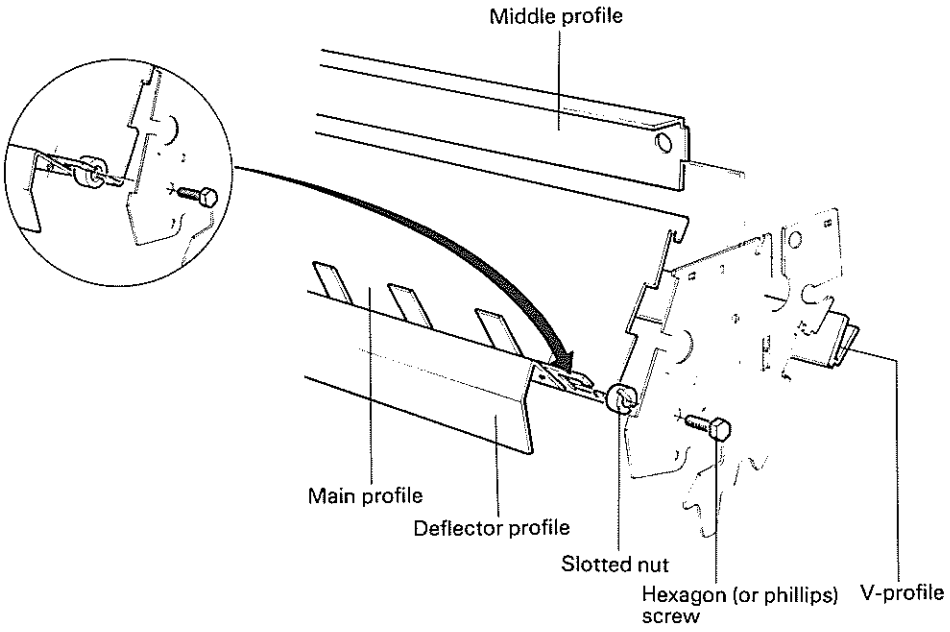


Fig. 3-17. Hexagon (or phillips) Screw Removal

3.1.5.12 Removing the Right Side Plate (#8331, #8333)

Step 1: Refer to section 3.1.5.3 and perform steps 1-6.
Step 2: Remove bearings on the right side plate.
Step 3: Remove the C-Clip from the gear wheel.
Step 4: Remove gear wheel.
Step 5: Refer to section 3.1.5.5 and perform step 2-4.
Step 6: Remove the belt pulley from the drive shaft.
Step 7: Detach the spring between the peg on the right side plate and the lock lever.
Step 8: Remove the bearing screw from the right side plate.
Step 9: Remove the right side plate.

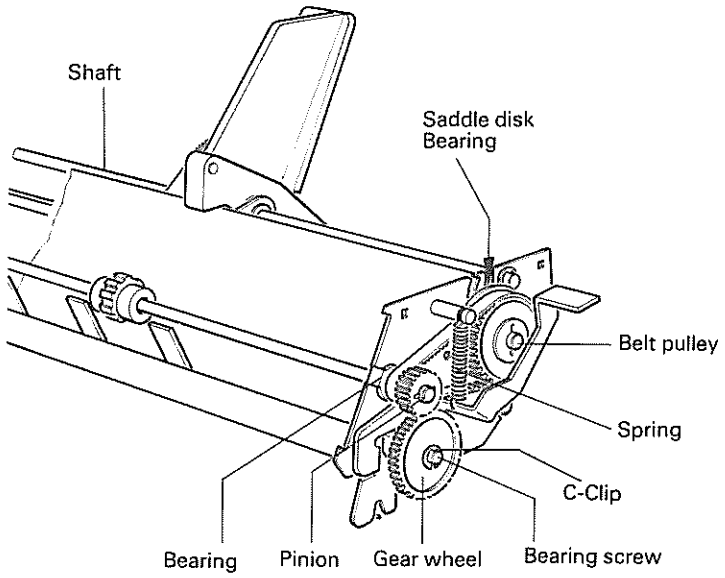


Fig. 3-18. Removing the Right Side Plate

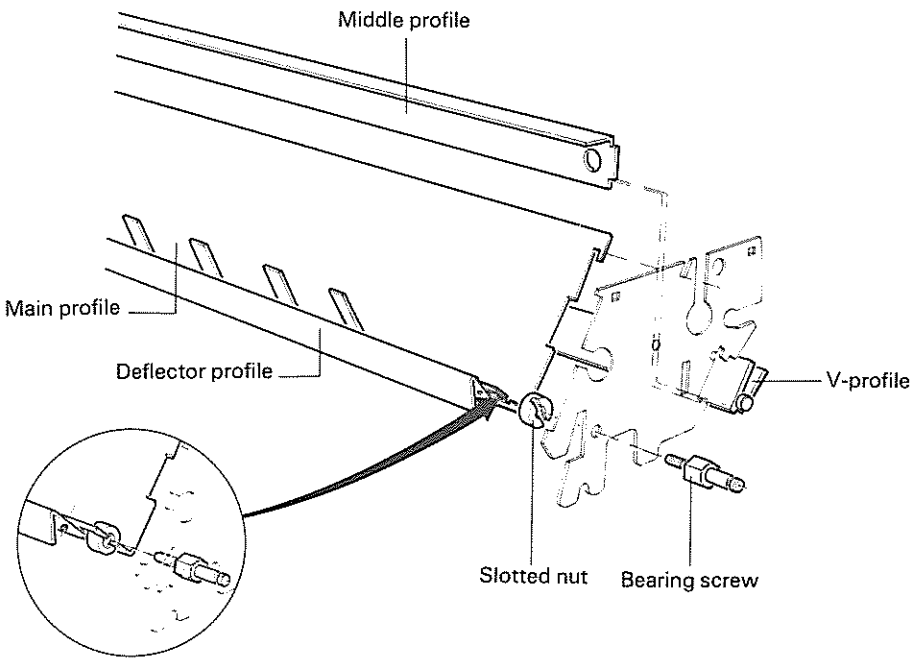


Fig. 3-19. Removing the Bearing Screws

CHAPTER 4
DISASSEMBLY, ASSEMBLY AND ADJUSTMENTS

LIST OF FIGURES

LIST OF TABLES

4.1 INTRODUCTION

This chapter describes how to remove printer main components for maintenance or repair purposes.

4.2 NECESSARY TOOLS AND MEASURING INSTRUMENTS

The tools and measuring instruments listed in Tables 4-1 and 4-2 are recommended for use when disassembling and/or repairing the printers. In addition, Symbol A at "Class" on Table 4-2 indicates that the listed measuring instrument are required for maintenance or repair service of the printer, while equipment rated B is desirable, but is not required.

Table 4-1. List of Tools

Name of tool	Type
Brush #1	○
Brush #2	○
Cleaning brush	○
Round nose pliers	○
Tweezers	○
Electric soldering iron	○
ET holder 2.5	○
ET holder 3	○
ET holder 4	○
ET holder 5	○
ET holder 6	○
(–) Screwdriver No. 1	○
(+) Screwdriver No. 1	○
(+) Screwdriver No. 2	○
Thickness gauge (0.65 mm)	Ⓔ
Tension gauge (1600 g)	○
Box screwdriver (opposite side distance 7 mm)	○

○ = Ordinary tool available commercially
Ⓔ = EPSON exclusive tool

Table 4-2. List of Measuring Instruments

Name	Description	Class
Oscilloscope	50 MHz	A
Tester		A
Multimeter		B
Logic analyzer		B

4.3 DISASSEMBLY AND ASSEMBLY

The disassembly section describes removal of the printer main components. Unless otherwise specified, component replacement can be accomplished by reversing the removal procedure. Disassembly will be addressed in three major sections:
Removal of printer upper case, disassembly of electrical circuit boards, and disassembly of printer mechanism. Only components referenced in Chapter 5, "Troubleshooting", are described here.

4.3.1 REMOVAL OF PRINTER UPPER CASE (Figs. 4-1, 4-2 and 4-3)

Step 1: Disconnect the printer from the power source and host computer, and remove paper, ribbon, and other accessories.

Step 2: Remove the manual paper feed knob.

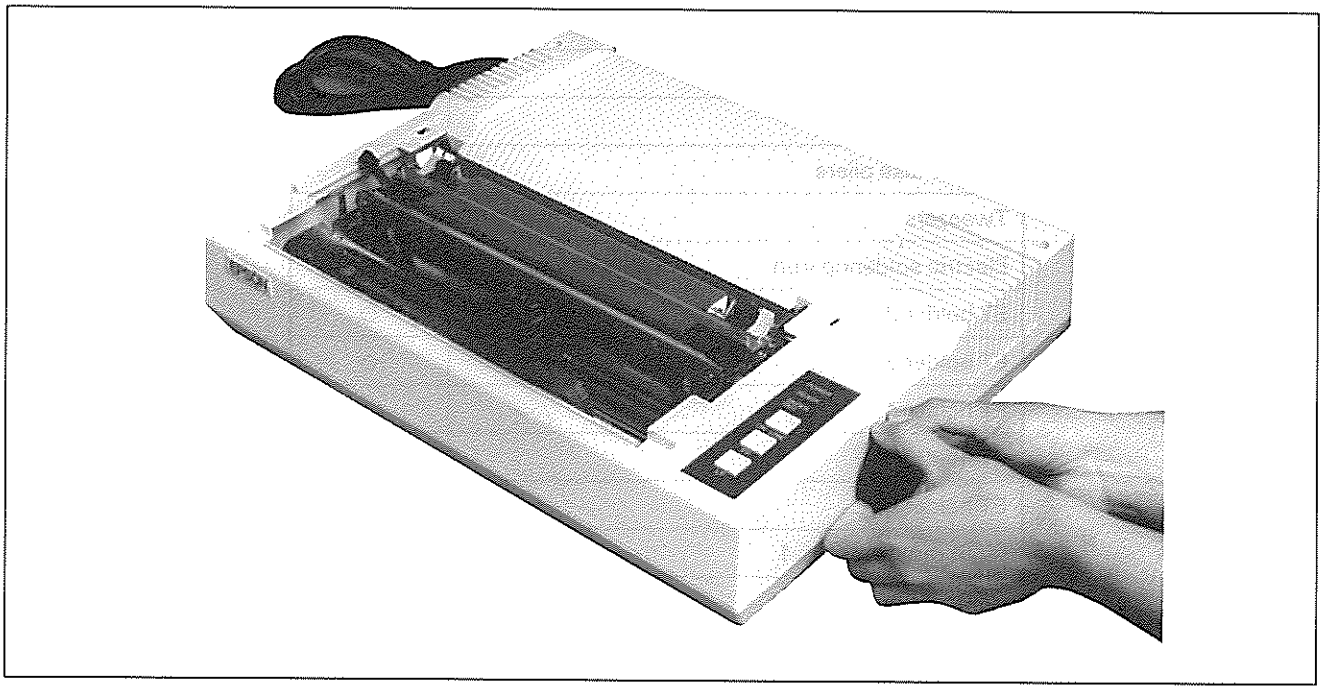


Fig. 4-1. Detaching Manual Paper Feed Knob

Step 3A: Remove the four fixing screws from the upper case. (FX-80+/FX-85)

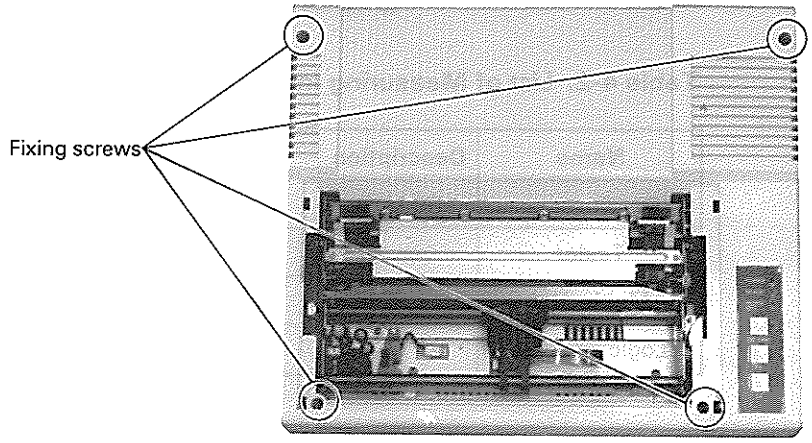


Fig. 4-2. Locations of Upper Case Fixing Screws (FX-80+/FX-85)

Step 3B: Remove the six fixing screws from the upper case. (FX-100+/FX-185/105)

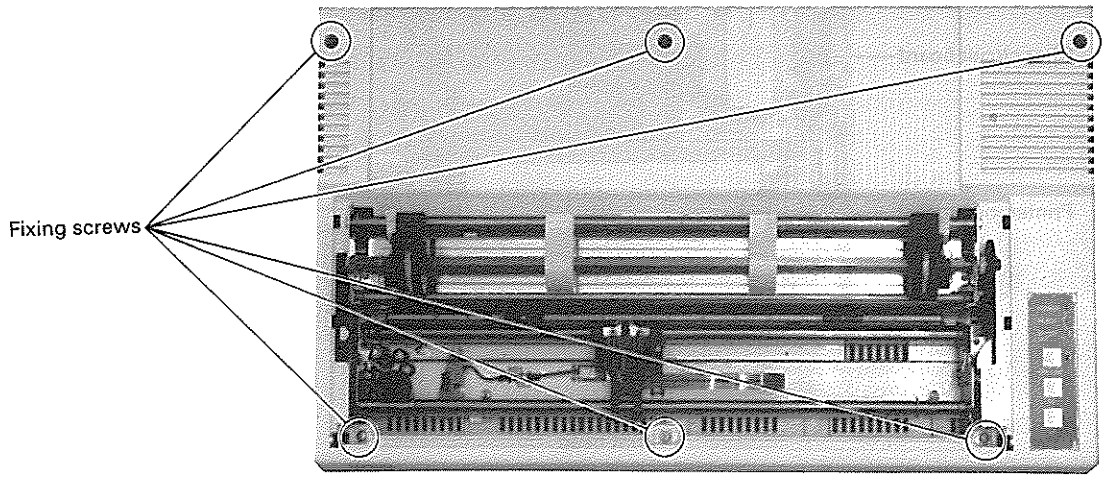


Fig. 4-3. Location of Upper Case Fixing Screws. (FX-100+/FX-185/105)

Step 4: Lift the upper case until the control panel connector (CN7) is exposed. Disconnect the connector (CN7) from the control circuit board.

Step 5: Remove the upper case. (See Figs. 4-4 to 4-7 for component configuration.)

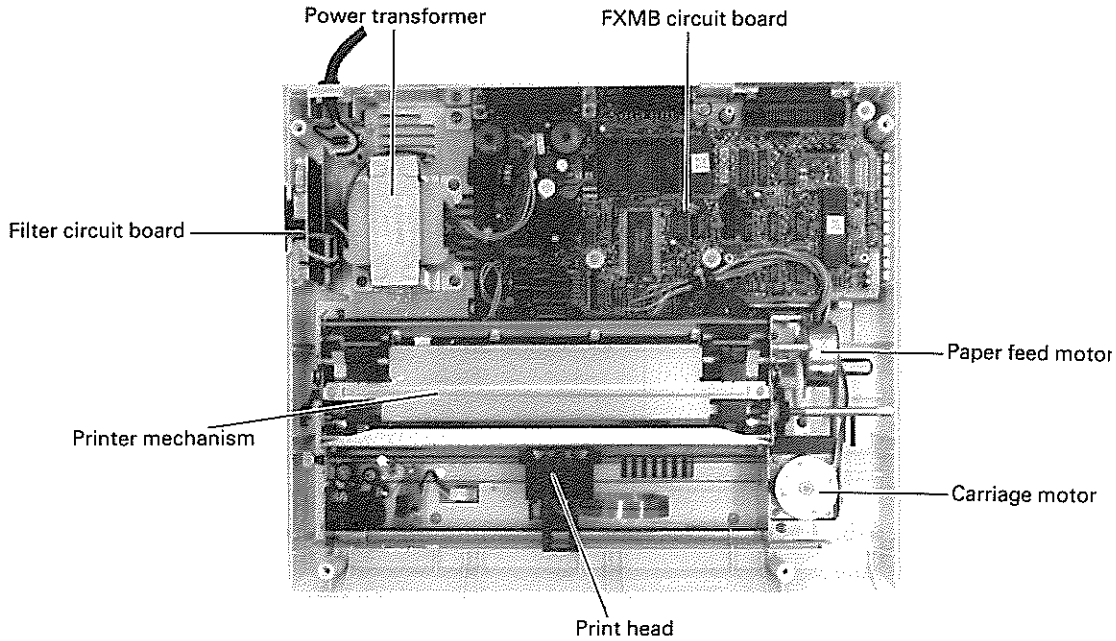


Fig. 4-4. Layout of Respective Components. (FX-80+)

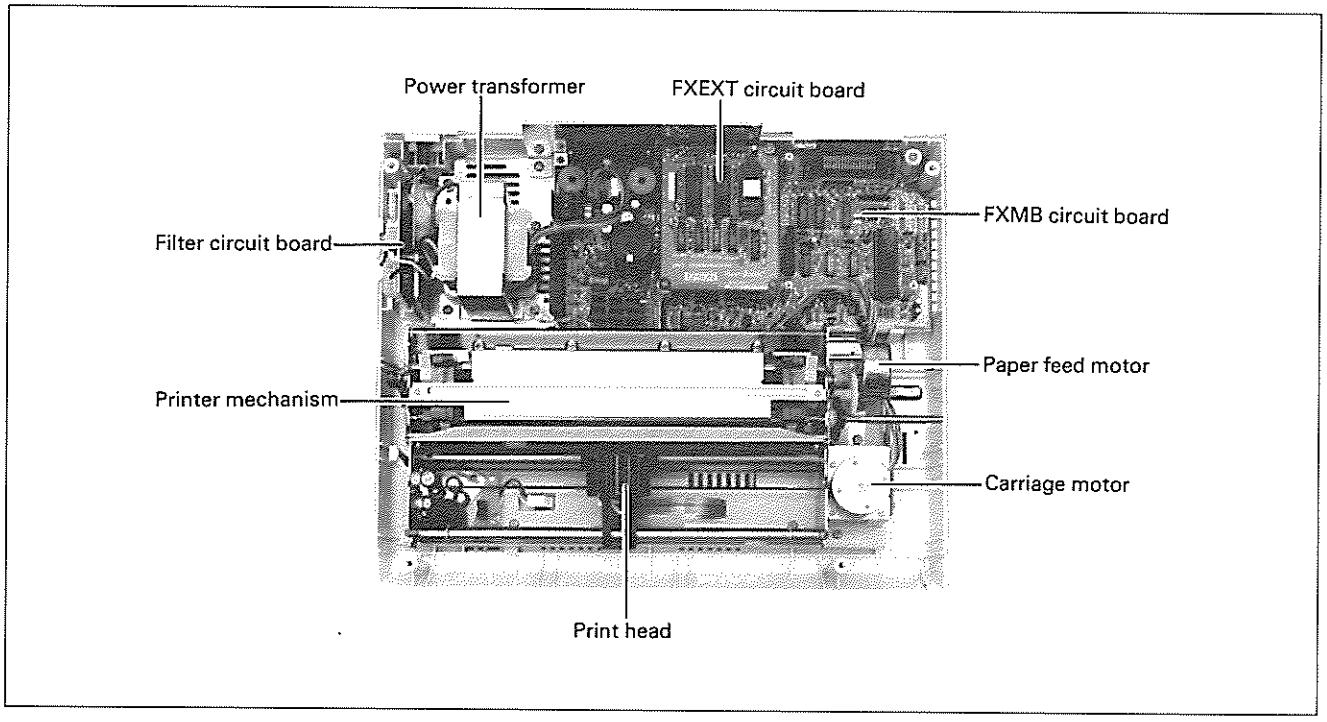


Fig. 4-5. Layout of Respective Components (FX-85)

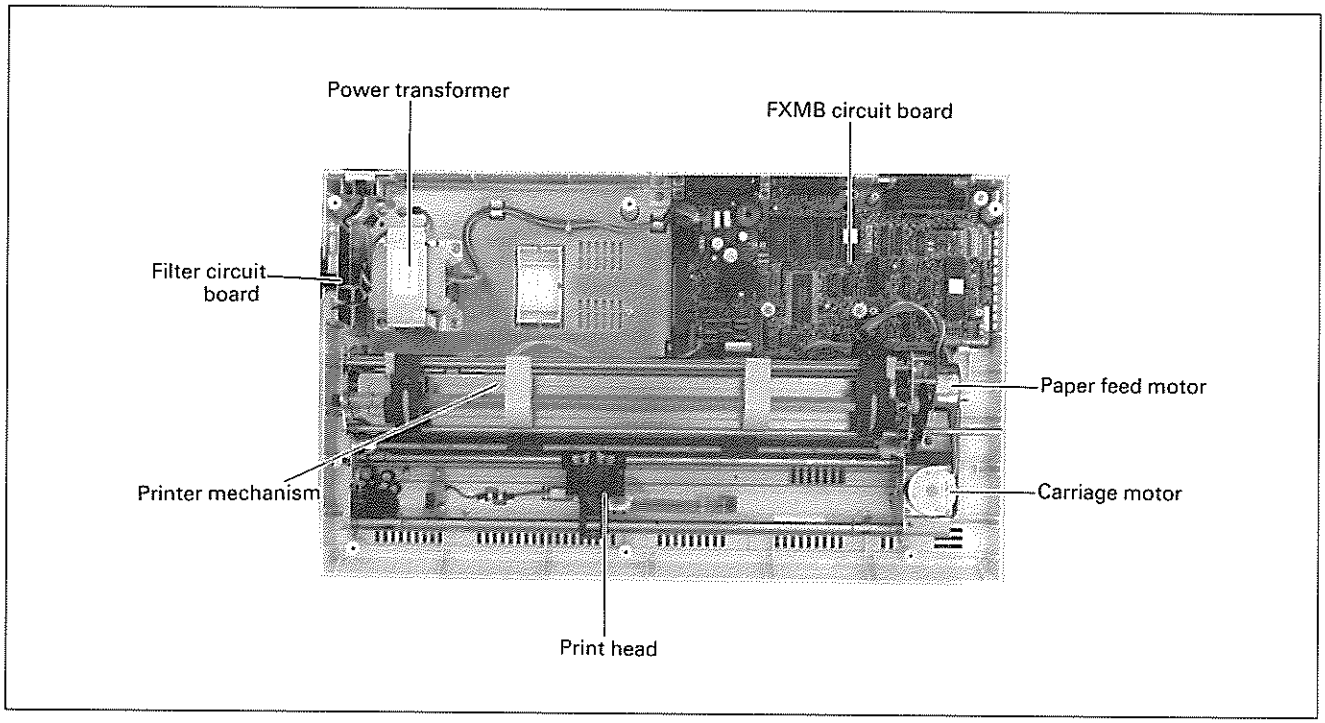


Fig. 4-6. Layout of Respective Components. (FX-100+)

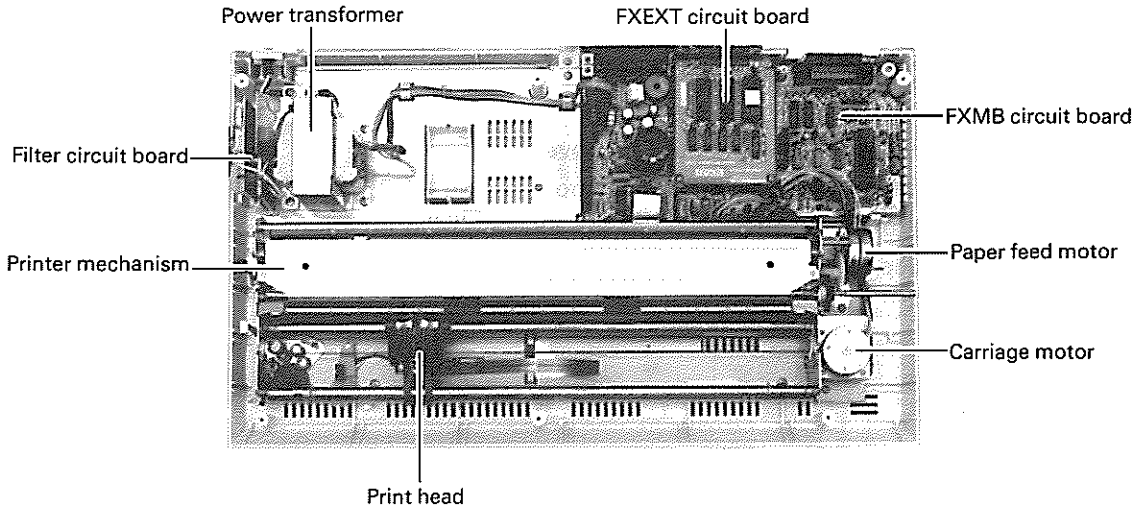


Fig. 4-7. Layout of Respective Components (FX-185/105)

4.3.2 DISASSEMBLY OF ELECTRIC CIRCUIT SECTION

Caution: Disconnect the printer from the power source before performing disassembly procedure

4.3.2.1 Removal of FXEXT Circuit Board (FX-85/185/105 models only)

CAUTION: Removing the circuit board forcibly may cause damage to the circuit board.

Step 1: Turn the power switch OFF, unplug the power cord from the power source and dosconnect the printer from any peripheral device.

Step 2: Remove the upper case. (Refer to 4.3.1)

Step 3: Remove the three FXEXT fixing screws.

Step 4: Remove the FXEXT circuit board.

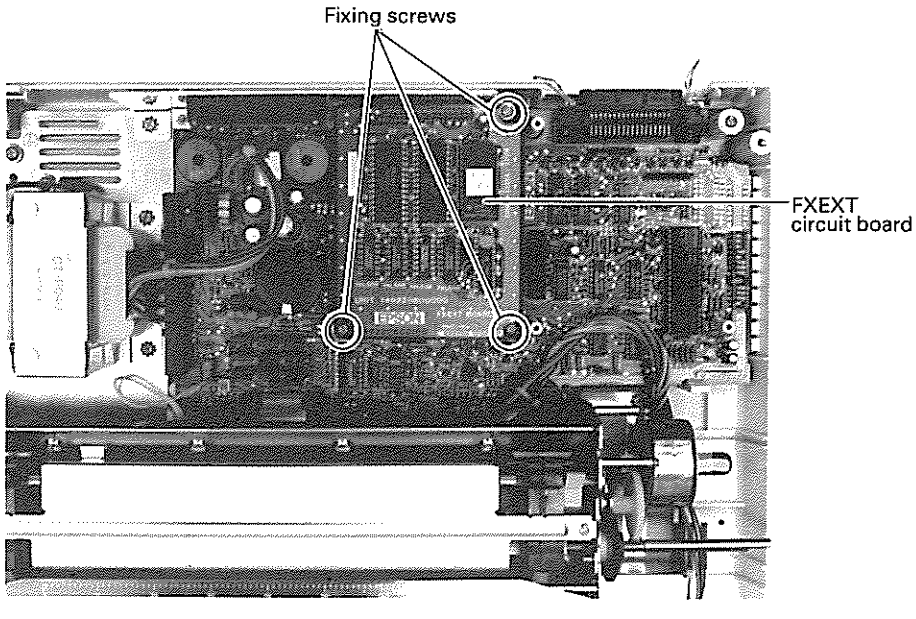


Fig. 4-8. Removal of FXEXT Circuit Board

4.3.2.2 Removal of FXMB Circuit Board (Figs. 4-9 and 4-10)

CAUTION: Removing the circuit board forcibly may cause damage to the circuit board.

Step 1: Turn the power switch OFF, unplug the power cord from the power source and disconnect the printer from any peripheral device.
Step 2: Remove the upper case. (Refer to 4.3.1)
Step 3: If an optional board has been inserted, remove it.
Step 4: Remove the FXEXT circuit board if printer model is the FX-85 or FX-185/105. (Refer to 4.3.2.1)
Step 5: Remove the board junction screw Ⓐ of the FXMB circuit board if printer model is the FX-85 or FX-185/105. (See Fig. 4-9)

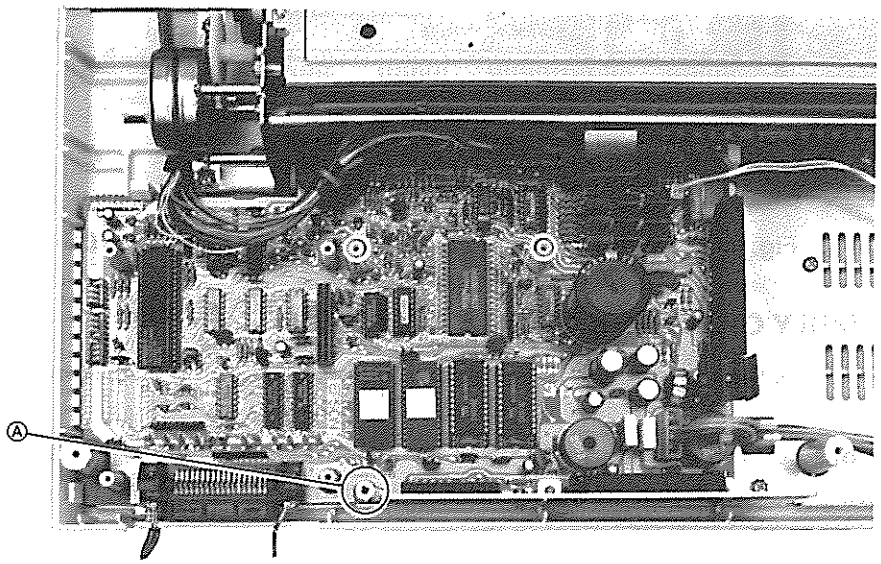


Fig. 4-9. Remove of the Board Junction Screw

Step 6: Connector CN6, which supplies AC from the power transformer, from the FXMB circuit board.
Step 7: Disconnect connector CN8, which sends the Paper End signal from the printer mechanism, from the FXMB circuit board.
Step 8: Disconnect connectors CN4 and CN5, which are connected to the printer mechanism, from the FXMB circuit board.
Step 9: Remove the three fixing screws ① of the FXMB circuit board, then remove the two screws ② attached to the chassis case.
Step 10: Release the two hooks (FX-80/FX-85) or three hooks (FX-100+/FX-185/105) which secure the FXMB circuit board to the case.
Step 11: Remove the FXMB circuit board carefully.

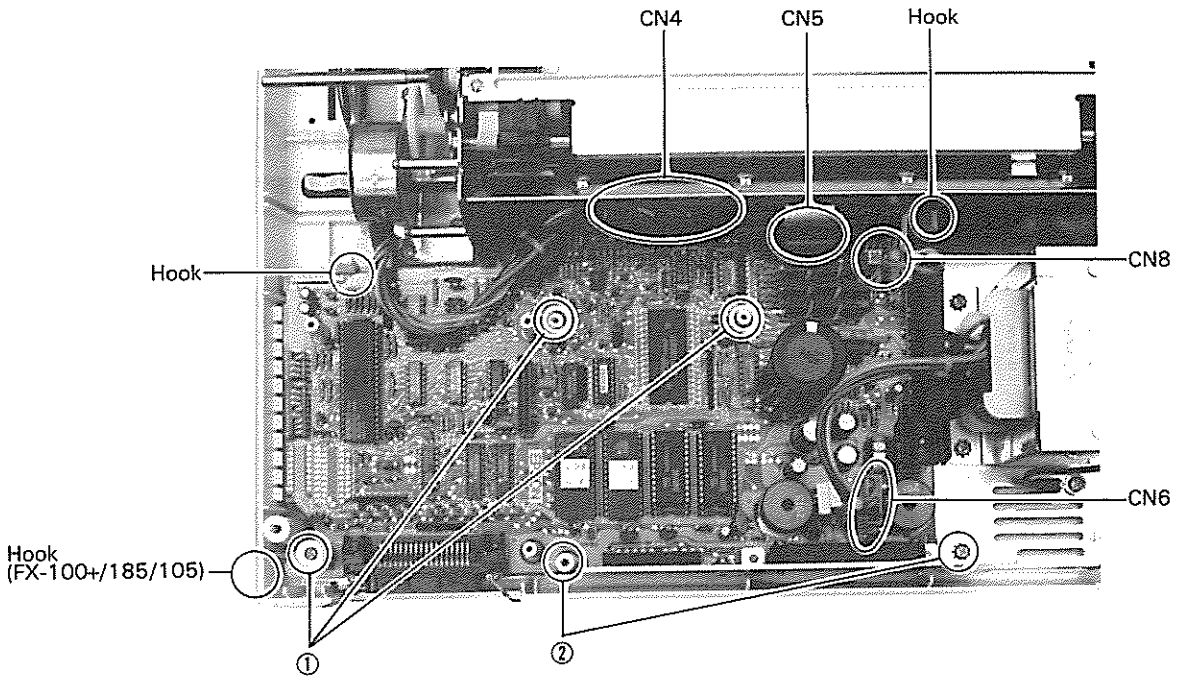


Fig. 4-10. Removal of FXMB Circuit Board

WARNING: When the new FXMB circuit board is installed in the printer, make sure that the DIP switch settings and jumper settings are correct.

4.3.2.3 Removal of Power Transformer

(1) 120V version (Fig. 4-11)

Step 1: Turn the power switch OFF, unplug the power cord from the power source and disconnect the printer from any peripheral devices.

Step 2: Remove the upper case. (Refer to 4.3.1)

Step 3: Disconnect connector CN1 (power transformer connector) from the FFIL circuit board.

Step 4: Disconnect connector CN6, which supplies power to the FXMB circuit board from the secondary side of the power transformer.

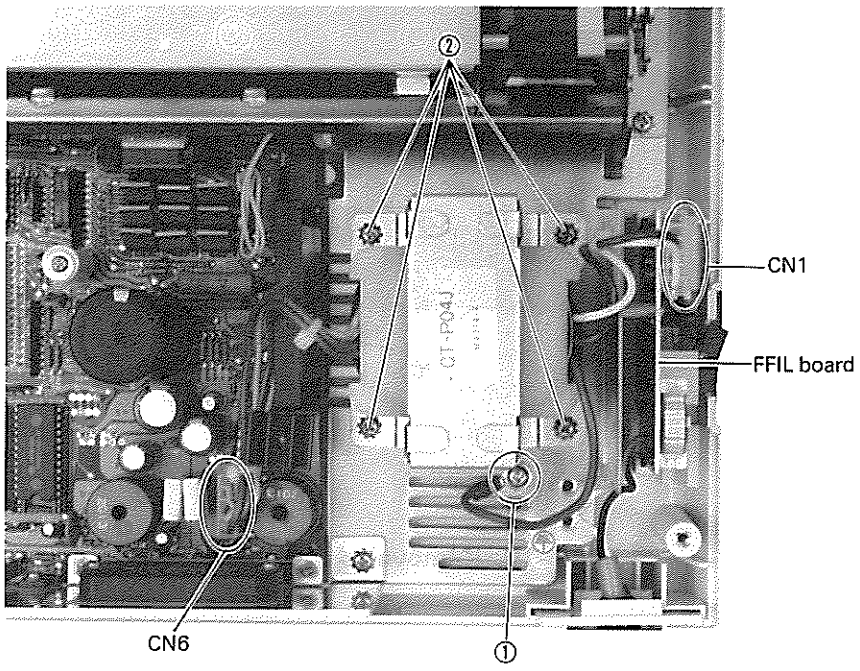


Fig. 4-11. Removal of Power Transformer (120V)

Step 5: Remove the fixing screw ① which holds the ground line from the power transformer to the base plate.

Step 6: Remove the four power transformer fixing screws ②.

Step 7: Remove the power transformer.

(2) 220/240V version (Figs. 4-12 and 4-13)

Step 1: Turn the power switch OFF, unplug the power cord from the power source and disconnect printer from any peripheral devices.

Step 2: Remove the upper case. (Refer to 4.3.1)

Step 3: Remove the fixing screw ① which secures the protective cover on the filter circuit board, then remove the protective cover.

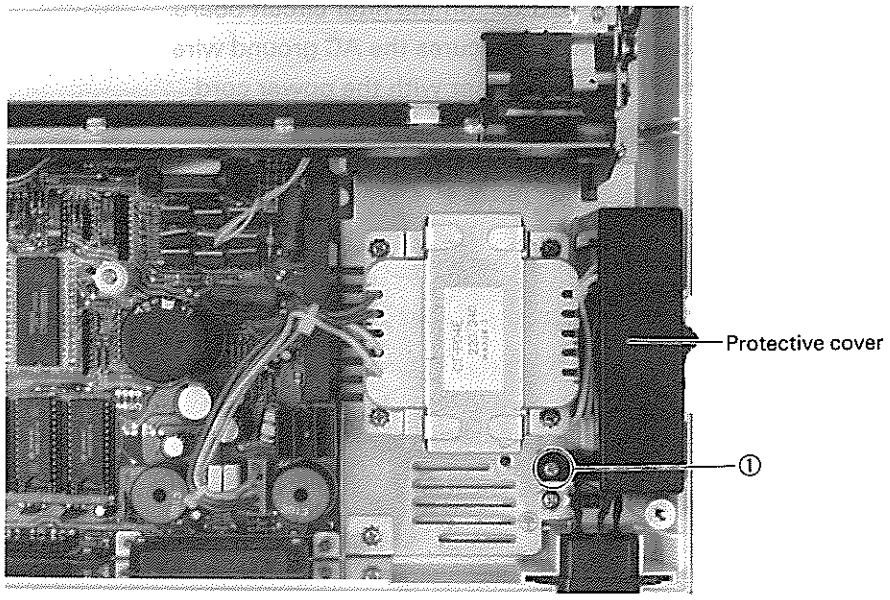


Fig. 4-12. Removal of Protective Cover (220/240V)

Step 4: Disconnect connector CN1 (power transformer connector) from the FFIL circuit board.

Step 5: Disconnect connector CN6, which supplies power to the FXMB circuit board from the secondary side of the power transformer.

Step 6: Remove the four power transformer fixing screws ②.

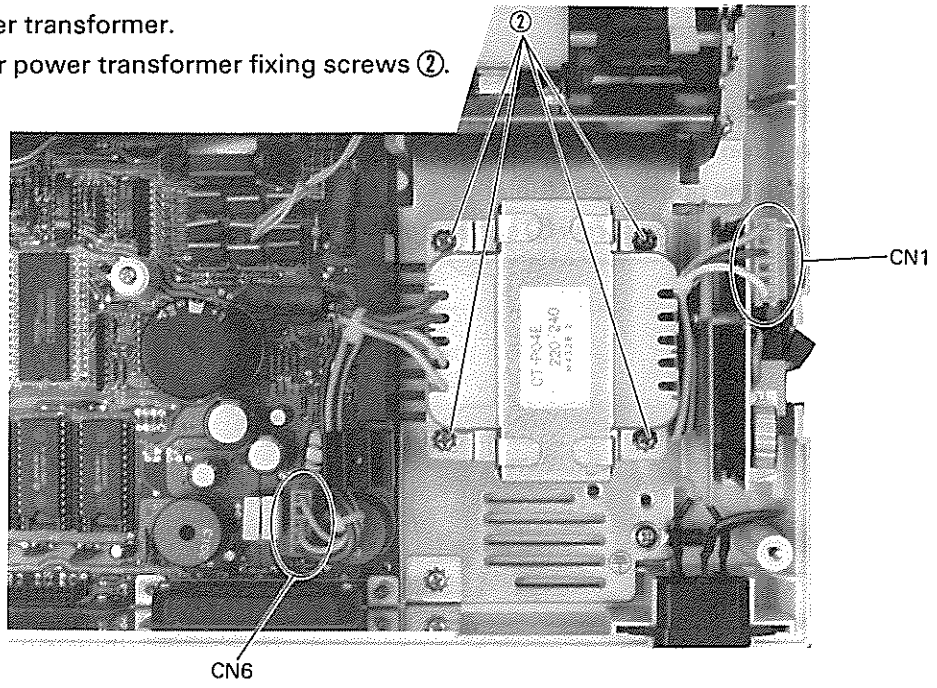


Fig. 4-13. Removal of Power Transformer (220/240V)

4.3.2.4 Removal of Filter Circuit Baord

NOTE: The removal procedures for 120V and 220/240V versions of the filter circuit board are not the same. Be sure that you are using the instructions applicable to the unit being serviced.

(1) 120V version (Fig. 4-14)

Step 1: Turn the power switch OFF, unplug the power cord from the power source and disconnect the printer from any peripheral devices.

Step 2: Remove the upper case. (Refer to 4.3.1)

Step 3: Disconnect connector CN1 from the filter circuit board.

Step 4: Remove the one screw ① at "CGND" on the filter circuit board.
Step 5: Remove the fixing screw ② which secures the AC ground wire.
Step 6: Remove the filter circuit board together with the power cord.

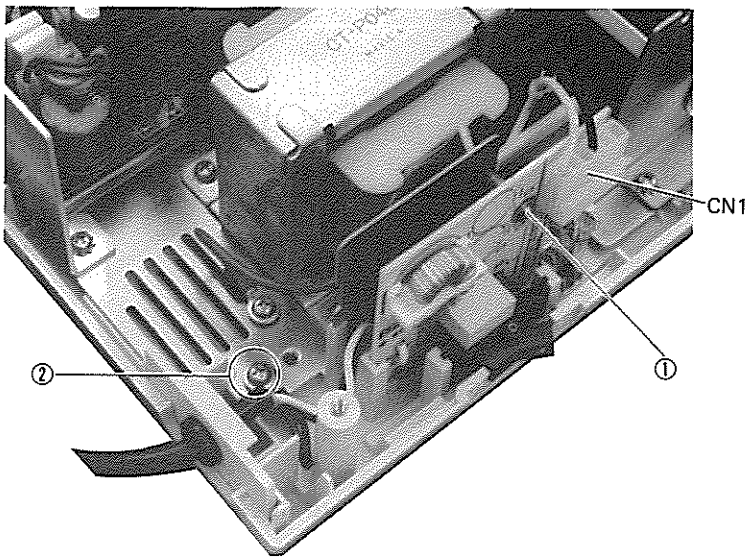


Fig. 4-14. Removal of Filter Circuit Board (120V)

(2) 220/240V version (Figs. 4-15 and 4-16)

Step 1: Turn the power switch OFF, unplug the power cord from the power source and disconnect the printer from any peripheral devices.
Step 2: Remove the upper case. (Refer to 4.3.1)
Step 3: Remove the fixing screw ① and remove the protective cover.

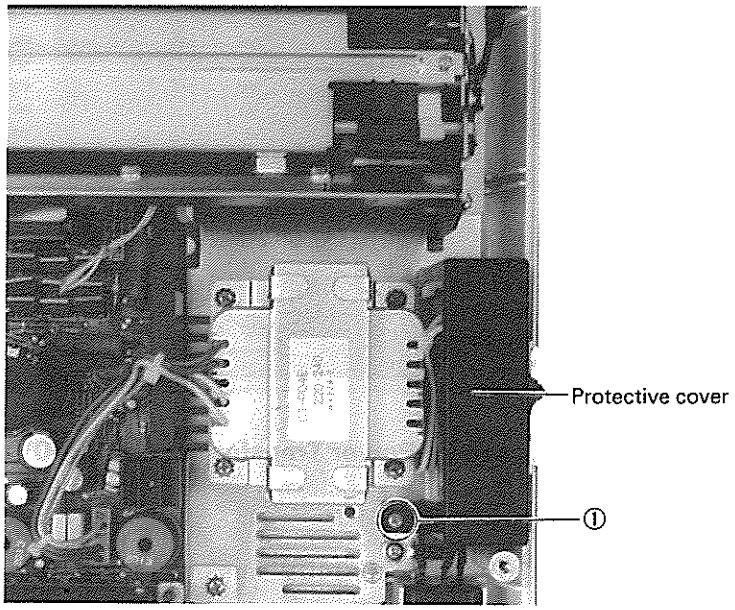


Fig. 4-15. Removal of Protective Cover (220/240V)

Step 4: Disconnect connector CN1 which supplies power to the power transformer.
Step 5: Remove the one screw ② at "CGND" on the filter circuit board.
Step 6: Remove the AC ground wire fixing screw ③ from the base plate.
Step 7: Lift up the filter circuit board.

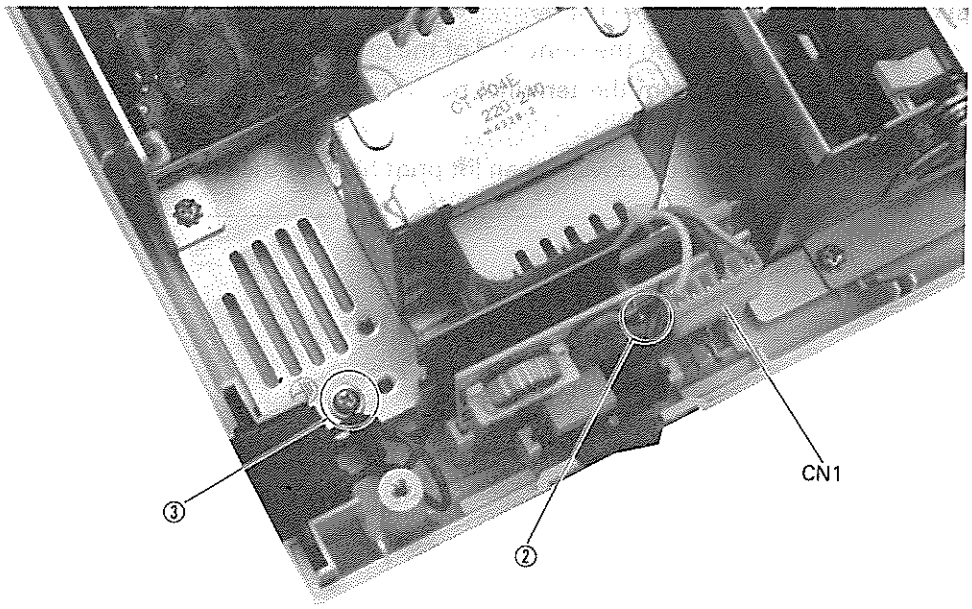


Fig. 4-16. Removal of Filter Circuit Board (220/240V)

4.3.3 DISASSEMBLY OF MODEL-3510/3560 PRINTER MECHANISM

4.3.3.1 Removal of Printer Mechanism (Fig. 4-17)

Remove the printer mechanism in the following manner:

Step 1: Remove the upper case (Refer to 4.3.1)
Step 2: Disconnect connecter CN4 from the FXMB circuit board.
Step 3: Disconnect connector CN5 from the FXMB circuit board.
Step 4: Disconnect connector CN8 from the FXMB circuit board.
Step 5: Remove the fixing screw ① from the ground plate between printer mechanism and base plate.
Step 6: Remove the four printer mechanism fixing screws ②.
Step 7: Removal the two shipping screws if they are fixed.
Step 8: Remove the printer mechanism.

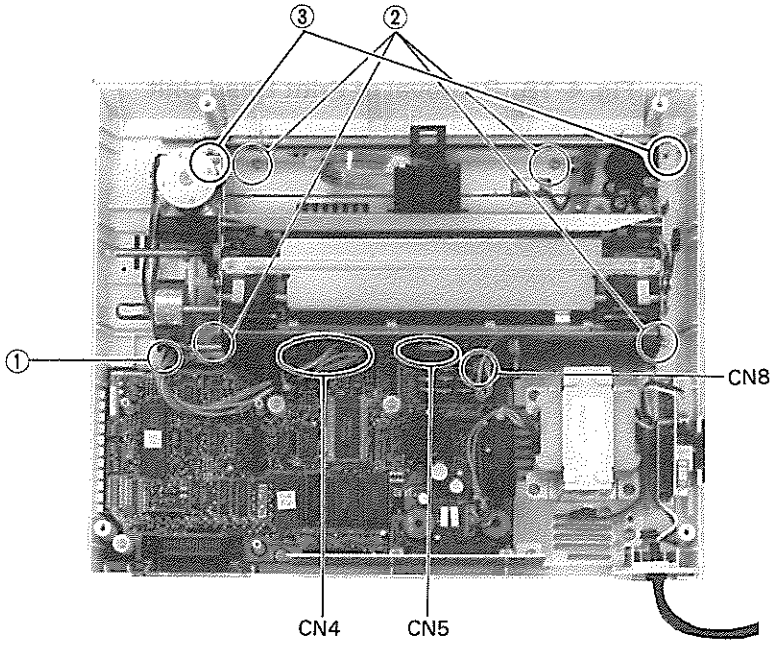


Fig. 41-17. Removal of Printer Mechanism

4.3.3.2 Removal of Print Head Unit (Fig. 4-18)

Step 1: Move the print head manually to the right end of the printer.

Step 2: Disconnect the head cable from the terminal board in the lower section of the printer mechanism.

Step 3: Rotate the head lock lever to clockwise, then lift print head of the carriage assembly.

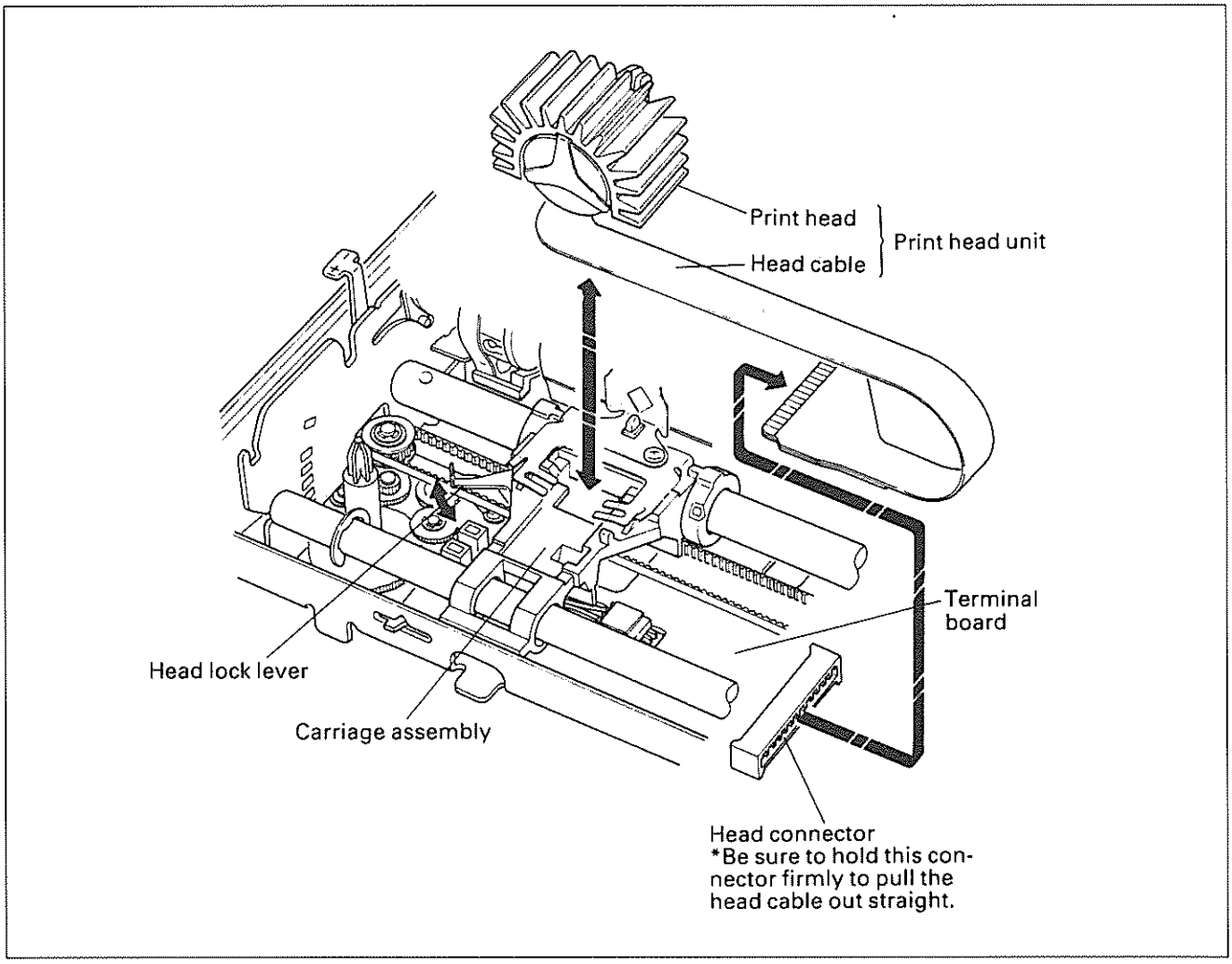


Fig. 4-18. Removal of Print Head Unit

4.3.3.3 Removal of Sensor Board

(1) Removal of Home Position Sensor Board (Fig. 4-19)

The H.P. sensor board is located at the left front side of the printer mechanism. Remove it as follows:

Step 1: Disconnect the H.P. sensor connector of the H.P. sensor board from the terminal board.

Step 2: Remove the cup screw.

Step 3: Remove the H.P. sensor board.

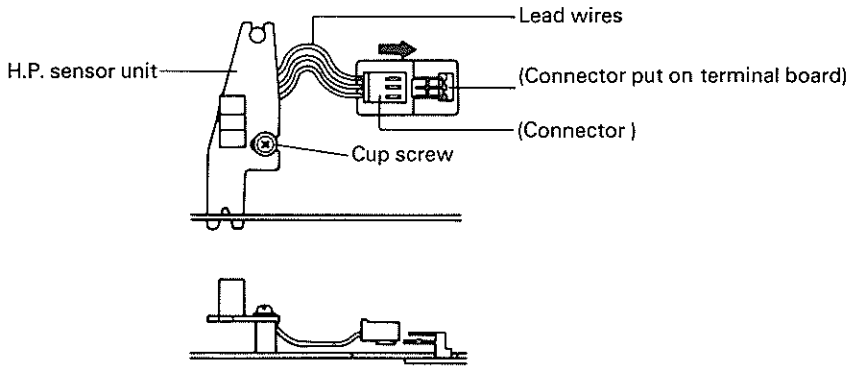


Fig. 4-19. Removal of Home Position Sensor Board

(2) Removal of Paper End Sensor Board (Fig. 4-20)

The P.E. sensor board is located at the left rear side of the printer mechanism.

Step 1: Remove the upper case. (Refer to 4.3.1)

Step 2: Remove the printer mechanism. (Refer to 4.3.3.1)

Step 3: Release the P.E. lever spring from the paper guide.

Step 4: The P.E. sensor board is secured to the outer paper guide with metal tabs. Bend the lower tabs outward and remove the P.E. sensor board.

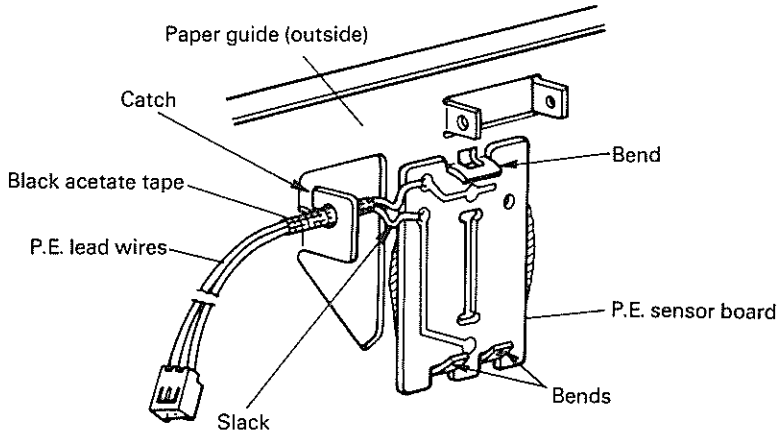


Fig. 4-20. Removal of Paper End Sensor Board

(3) Removal of PTS Sensor Board (Fig. 4-21)

Step 1: Remove the upper case. (Refer to 4.3.1)
Step 2: Disconnect the four lead wires on the PTS sensor board.
Step 3: Remove the cup screw.
Step 4: Remove the PTS sensor board.

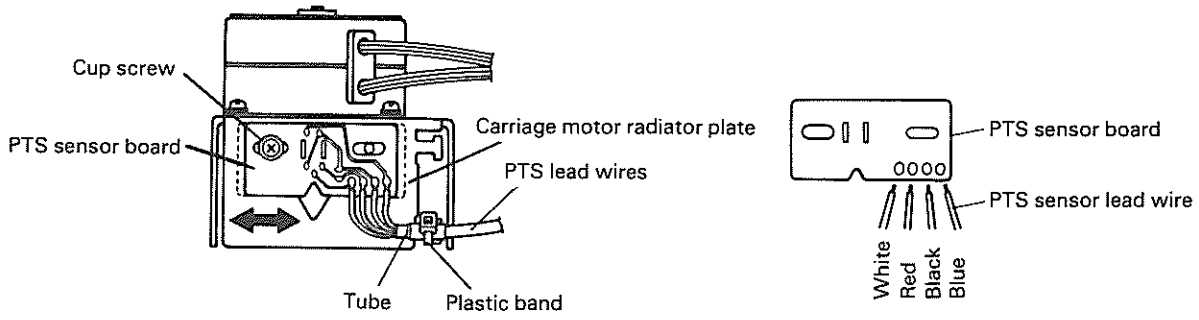


Fig. 4-21. Removal of PTS Sensor Board

4.3.3.4 Removal of Motors

The Model-3510/3560 printer mechanism has two motors, they are both connected to the FXMB circuit board via a compound connector CN4.

(1) Removal of Carriage Motor (Fig. 4-22)

This motor is attached to the right side of the printer mechanism. Whenever the carriage motor is replaced, backlash adjustment should be made.

Step 1: Remove the upper case. (Refer to 4.3.1)
Step 2: Cut the two plastic bands which hold the motor wires.
Step 3: Remove the four screws fixing the carriage motor to the radiator plate.
Step 4: Release the carriage motor connector CN4 on the FXMB circuit board.
Step 5: Remove the carriage motor.

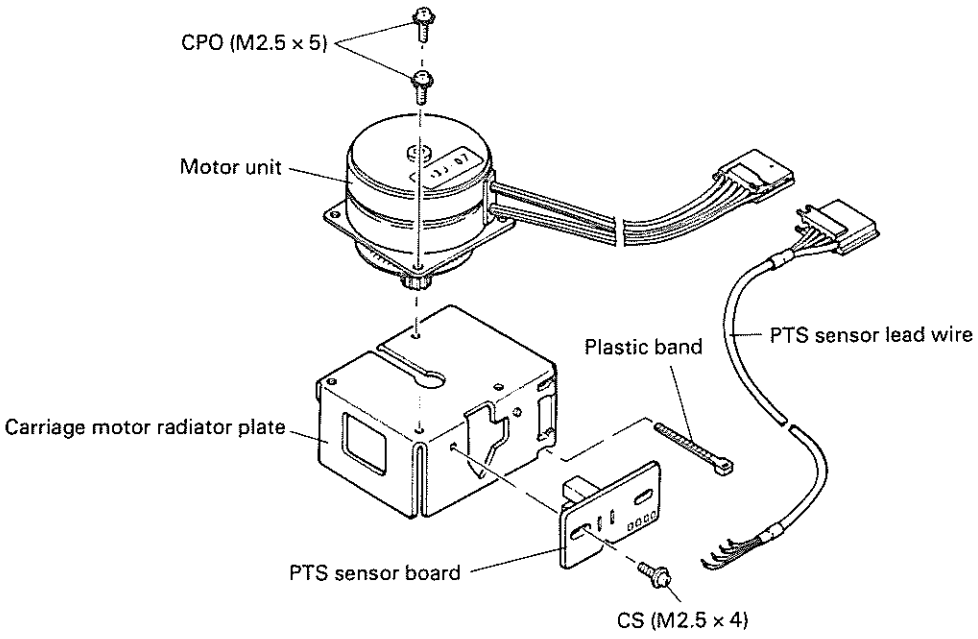


Fig. 4-22. Removal of Carriage Motor

(2) Removal of Paper Feed Motor (Fig. 4-23)

The paper feed motor is positioned behind the carriage motor at the right side of the printer mechanism.

CAUTION: Whenever the paper feed motor is replaced, backlash adjustment should be made.

Step 1: Remove the upper case. (Refer to 4.3.1)
Step 2: Cut the two plastic bands which hold the paper feed motor wires.
Step 3: Remove the two screws which secure the paper feed motor.
Step 4: Disconnect the paper feed motor connector from the compound connector CN4 on the FXMB circuit board.
Step 5: Remove the paper feed motor.

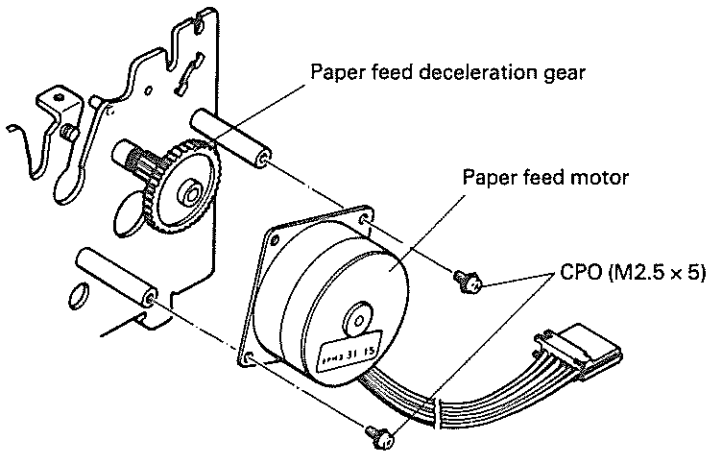


Fig. 4-23. Removal of Paper Feed Motor

4.4 ADJUSTMENTS

This section describes the adjustment methods required when replace the components (sensor board, etc.) relative to the motors and the operation timing in the printer mechanism.
When one of these components are removed or replaced during maintenance or repair service, the necessary adjustment should be made to assure correct operation of the printer.

WARNING: Use extreme caution when the power supply cable must be connected to perform test procedures. Potentially harmful voltage are present.

4.4.1 ADJUSTING THE H.P. SENSOR BOARD (Fig. 4-14)

Step 1: Set the paper and ribbon cartridge in the printer then print out character "H" for 8 lines.
Step 2: Marked on the scale shaft should align with the center of each printed character (See Fig. 4-24). If marks and characters are not correctly aligned, and adjustment is required.

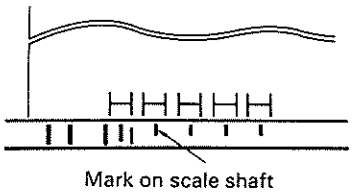


Fig. 4-24. Printing Position

Step 3: Loosen the cup screw on the H.P. sensor board. (See Fig. 4-19)
Step 4: Turn the power OFF and move the H.P. sensor board to adjust.
Step 5: After adjustment is complete, tighten the H.P. sensor board cup screw, and reassemble the printer.

4.4.2 CARRIAGE MOTOR ADJUSTMENT (Fig. 4-25)

To minimize backlash between the carriage motor and belt driven pulley subset.

Step 1: Loosen the two screws securing the motor and the base frame supports.

Step 2: Move the motor manually, then perform backlash adjustment. The reference value is 0.05 – 0.15 mm. After adjustment is complete, temporarily tighten the above screws.

Step 3: Move the carriage manually to check that the reference value is met at three points (left, center and right) within the driving range of the carriage.

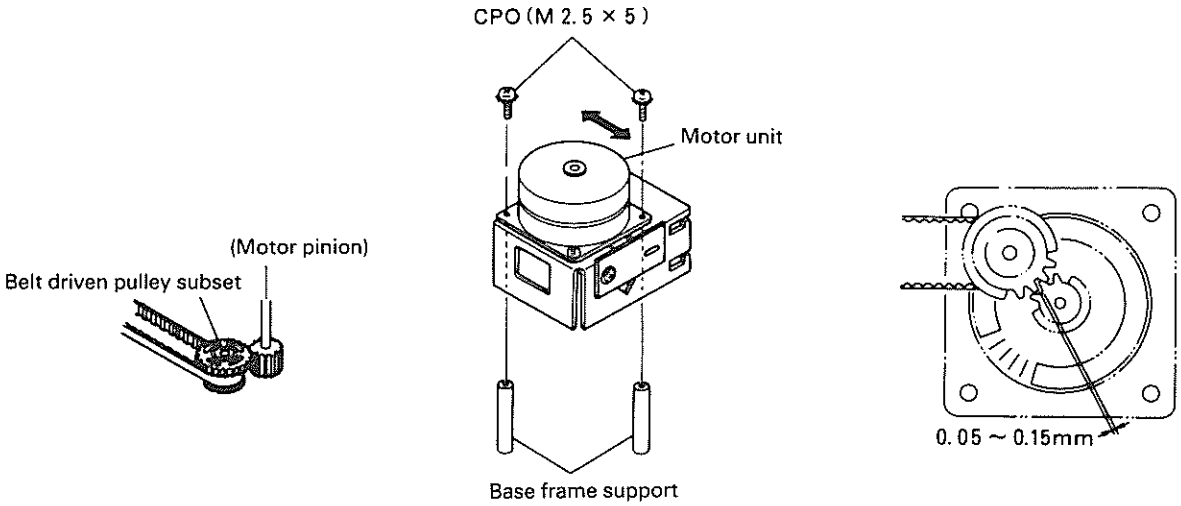


Fig. 4-25. Carriage Motor Adjustment

4.4.3 CARRIAGE MOTOR AND PTS SENSOR BOARD ADJUSTMENT (Figs. 4-26 and 4-27)

Step 1: Connect the printer to a synchroscope and activate the printer self-test to check the PTS signal. The timing period (T) should be almost the same in both directions. (See Fig. 4-26)

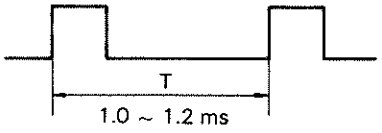


Fig. 4-26. PTS Timing

Step 2: If the waveform deviates from the permissible timing range, perform steps 3 – 5.

Step 3: Loosen the cup screw on the PTS sensor board.

Step 4: Move the PTS sensor board in the direction of the arrow. (See Fig. 4-27)

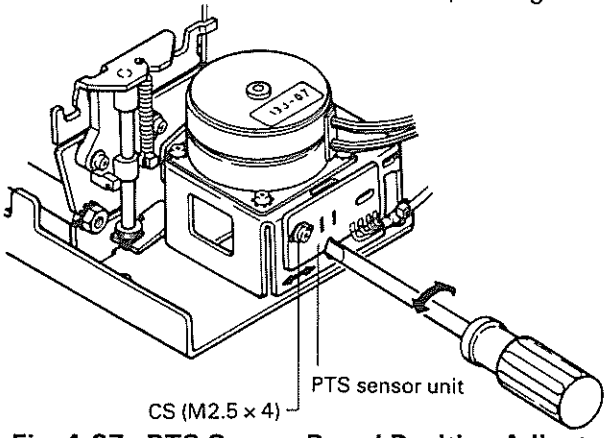


Fig. 4-27. PTS Sensor Board Position Adjustment

Step 5: Tighten the cup screw on the PTS sensor board.

4.4.4 PAPER FEED MOTOR ADJUSTMENT (Fig. 4-28)

To minimize backlash between the paper feed motor and paper feed reduction gear:

Step 1: Loosen the three screws which secure the paper feed motor and the frame supports.

Step 2: Move the motor manually, then perform backlash adjustment. The reference value is 0.05 – 0.15 mm. After adjustment is complete, temporarily tighten the above screws.

Step 3: Rotate the paper feed motor manually and check backlash at several points.

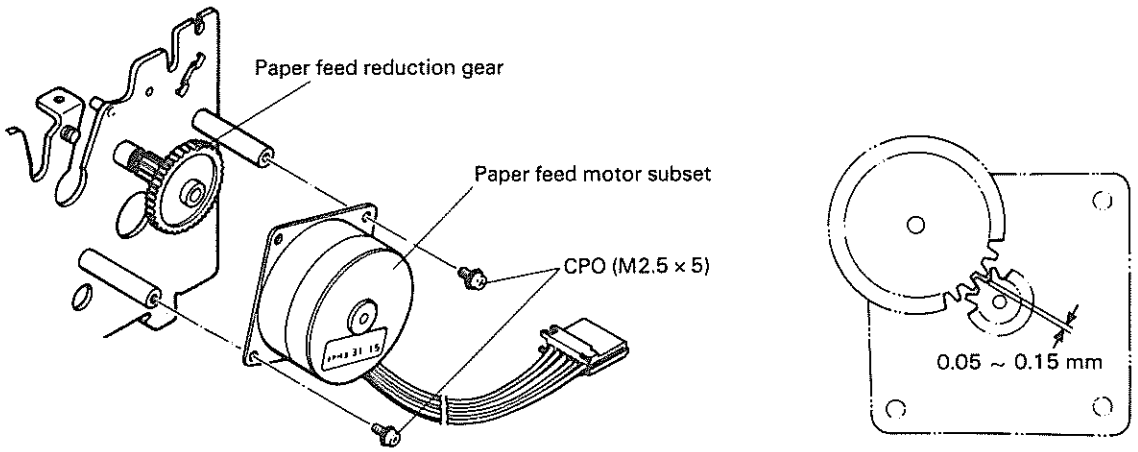


Fig. 4-28. Paper Feed Motor Adjustment

Step 4: When the adjustment has been successfully completed, tighten the three screws which secure the motor and reassemble the printer components.

4.4.5 PRINT HEAD-PLATEN GAP ADJUSTMENT (Figs. 4-29, 30 and 4-31)

This adjustment is performed when the platen unit or the carriage guide shaft B is replaced.

Step 1: Slightly loosen the lock nut (HNO-44) holding the adjusting lever.

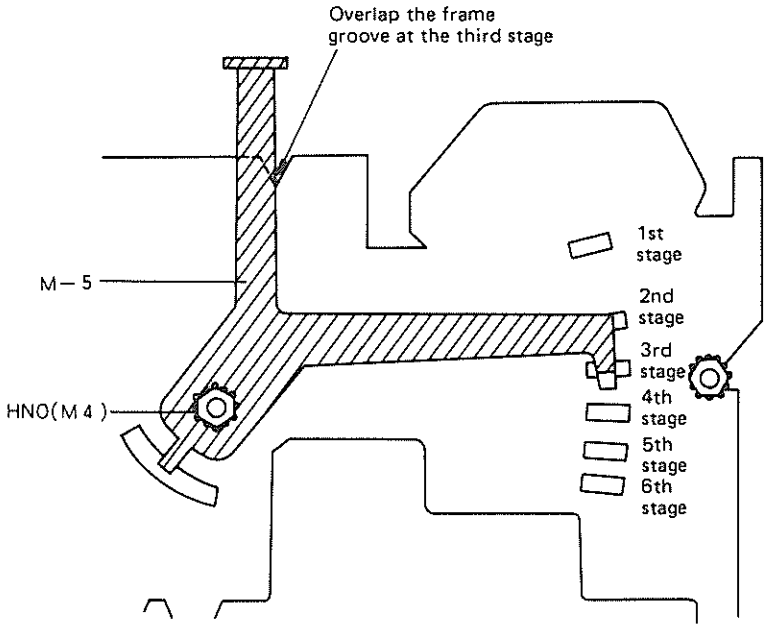


Fig. 4-29. Adjusting Lever

Step 2: Turn the greater eccentricity half of the carriage guide shaft B upwards.

Step 3: Set the adjust lever to the third step. (See Fig. 4-29)

Step 4: Rotate carriage guide shaft B in the direction of the arrow as shown in Fig. 4-30 for adjustment. The reference value is 0.6 mm. (See Fig. 4-31)

Step 5: After adjustment is complete, temporatily tighten the lock nut.

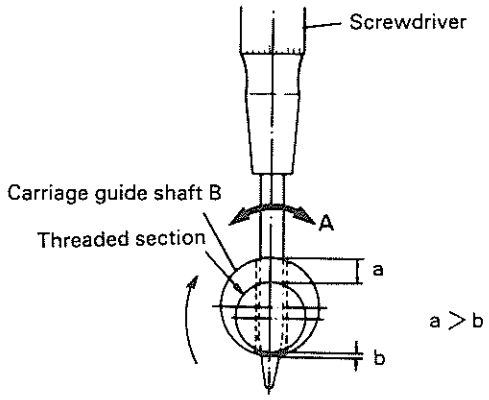


Fig. 4-30. Carriage Guide Shaft Adjustment

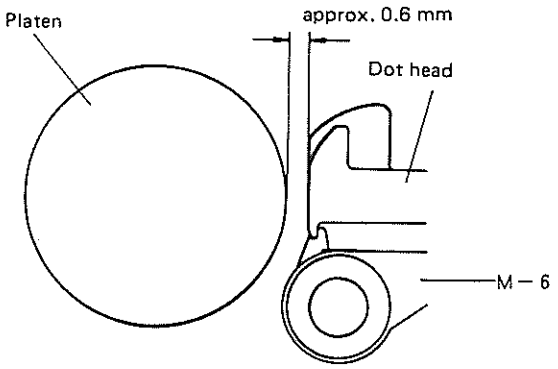


Fig. 4-31. Gap Between Platen and Print Head

Step 6: Move the carriage to check that the reference value is met at 3 points (left, center and right). If it not, perform adjustment again according to the steps above.

Step 7: Completely tighten the lock nut.

4.4.6 RIBBON MASK POSITION ADJUSTMENT

Before this adjustment, check 4.4.5 "Print Head Platen Gap Adjustment".

Step 1: Set the adjusting lever to the third step.

Step 2: loosen the fixing screw (CB, M2.5 x 5) of the ribbon mask.

Step 3: Establish positioned relation ship between the ribbon mask, print head and platen as shown in Fig. 4-32 (Reference value, a > b > 0.1 mm).

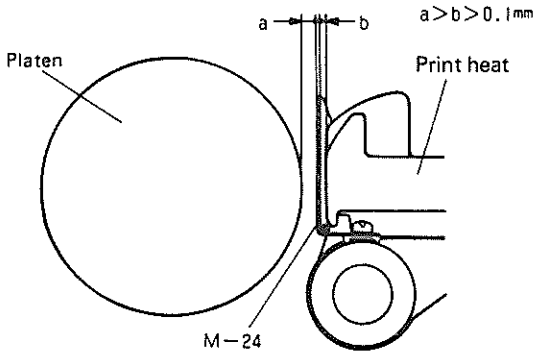


Fig. 4-32. Ribbon Mask Position (A)

Step 4: Check that the ribbon mask and the platen are parallel with each other. Then tighten the fixing screw of the ribbon mask (Tightening torque; 2 kg – cm)

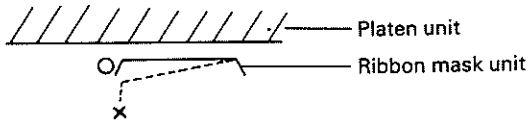


Fig. 4-33. Ribbon Mask Position (B)

Step 5: Move the carriage manually to check the ribbon mask mounting condition at 3 points (left, center and right).

CHAPTER 5
TROUBLESHOOTING

LIST OF FIGURES

LIST OF TABLES

5.1 TROUBLESHOOTING PROCEDURE

When followed in order of presentation the problem evaluation procedures outlined below are felt to be the most efficient method for isolating a defective component. Once the malfunctioning component is identified, refer to the Disassembly Assembly And Adjustment section for repair/replacement instructions.

1. Problem Diagnosis By Symptom
   Procedure: Symptom diagnosis by evaluation of printer malfunction signals; procedures performed with aid of tester or multimeter, as required. (No use of oscilloscope or synchroscope.)
   Level: Requires a thorough familiarity with printers and their principles of operation.
2. Diagnosis By Component Evaluation
   Procedure: Component evaluation by inspection and/or component exchange.
   Multimeter or tester used as required.
   Level: Requires a thorough familiarity with printers and their principles of operation.
3. Problem Diagnosis By Circuit Evaluation
   Procedure: Circuit evaluation using an oscilloscope to identify deviant waveforms.
   Level: Requires a high-degree of electrical knowledge.
4. Precautions
   (1) Perform each check item which appears on the troubleshooting flow chart. When a unit or a component part is replaced without following this procedure, the replacement unit or component may be damaged again in the same manner.
   (2) When losing the route of the flow chart, return to the beginning and start again.
   (3) When running on a loop in the flow chart, return to the beginning and start again.

- It is recommended that listed electrical circuit components be kept available as spare parts for repair purposes.

Table 5-1. Electric Circuit Parts (Common Parts)

Component	Part Number
Filter Circuit Board (FFIL board) 120V	Y440203100
Filter Circuit Board (FFIL board) 220V/240V	Y440203200
FXMB Circuit Board	Y440212000
Main CPU (μPD7810G)	X400078100
Slave CPU (CH2040KB)	Y440800007
2K byte RAM (4016)	Y400040161
Regulator IC (STK7563F)	Y440756310
Hybrid IC (STK6982)	Y440759820
Power Transformer for the FX-80+/FX-85 (CT-P04U) 120V	Y440511000
Power Transformer for the FX-80+/FX-85 (CT-P04E) 220V	Y440503000
Power Transformer for the FX-80+/FX-85 (CT-P04E) 240V	Y440504000
Power Transformer for the FX-100+/FX-185/105 (CT-P04U-a-4) 120V	Y440513000
Power Transformer for the FX-100+/FX-185/105 (CT-P04E-a-220/240-2) 220V	Y440508000
Power Transformer for the FX-100+/FX-185/105 (CT-P04E-a-240/220-2) 240V	Y440509000
Fuse (2A) 125V (120V version)	X502060020
Fuse (800mA) 250V (220/240V version)	X502014020

Table 5-2. Electric Circuit Parts (FX-80+/100+)

Component	Part Number
23128 mask ROM (M12068BB) for the FX-80+	Y440804401
23128 mask ROM (M12069KB) for the FX-100+	Y441801701
Fuse ROM (M20214GA)	Y440800101
Control Panel (FPEL)	Y440505000

Table 5-3. Electric Circuit Parts (FX-85/185/105)

Component	Part Number
27128 PROM (FC5-V2) LOC. 5A for the FX-85	Y440800111
2764 PROM (FX4-V1) LOC. 4A	Y440800010
27128 PROM (FA5-V2) LOC. 5A for the FX-185/105	Y441800107
FXEXT Circuit Board	Y492208000
27128 PROM (FE5-V1) LOC. 5A...FXEXT	Y440800009
4168 (8 Kbyte SRAM) LOC. 1A, 3A...FXEXT	X400041682
Fuse ROM (M02016GA)	Y492800101
Control Panel (FPEL-SQ)	Y440514000

- It is recommended that listed printer mechanism components be kept available as spare parts for mechanism repair.

Table 5-4. Printer Mechanism Parts

Component	Part Number
M-3510 Printer Mechanism for FX-80+	Y440590000
M-3510Printer Mechanism for FX-85	Y440590100
M-3560 Printer Mechanism for FX-100+	Y441590000
M-3560 Printer Mechanism for FX-185/105	Y441590200
Reed Switch (P.E. Sensor)	A170202502
PTS Sensor Board Ass'y	F315060000
HP Sensor Board Ass'y	F315056000
Carriage Motor Ass'y	F315059000
Paper Feed Motor Ass'y	F321054000

5.2 PROBLEM DIAGNOSIS BY SYMPTOM

This section addresses those symptoms which are clear indicators of a particular component malfunction. In some instances, the sophisticated Printer alarm system indicates which component is malfunctioning by the alarm signal pattern emitted (Table 5-5).
Problem indicators are discussed as follows:

(1) Alarm System Signals

- The fault is identified by the sound pattern of the buzzer at power ON.

(2) Printer Does not Operate Even with Power Switch ON

- Carriage does not move.
- No indicator on the control panel lights.

(3) Abnormal Carriage Operation

- Carriage moves away from home position at power ON.
- Although the carriage returns to the home position, it does not enter READY mode.

(4) Incorrect Printing (in self-print test) with Normal Carriage Operation

- No printing is executed.
- Some dots do not appear.

(5) Abnormal Paper Feed

- No paper is fed.
- Separation between lines varies with irregular paper feed.

(6) Abnormal Operation of Control Panel

- No paper is fed (even by operation of the LF or FF switch) in OFF-LINE mode.
- No operation mode is set from the control panel.
- ON-LINE or OFF-LINE mode is not obtained.

(7) Incorrect Printing in ON-LINE Mode

- Carriage operates normally at power ON and the result of the self-print test is correct. However, the print data from the computer is not output normally.

(1) Alarm System Signals

Table 5-5. Sound Patterns of Buzzer

Sound Pattern	Meaning
Pi, Pi, Pi, Pi (5 times over)	PE sensor (out of paper) detection error
P, Pi, Pi,..., Pi, Pi, Pi	Slave CPU detection error
Peep, Peep, Peep, Peep	Head driver transistor short-circuited
Pi, Pi, Pi, Peep	Abnormally high voltage detected

NOTE: For details of the alarm system, refer to Section 2.4.4.

(2) Correspondence of dot wires with FPC

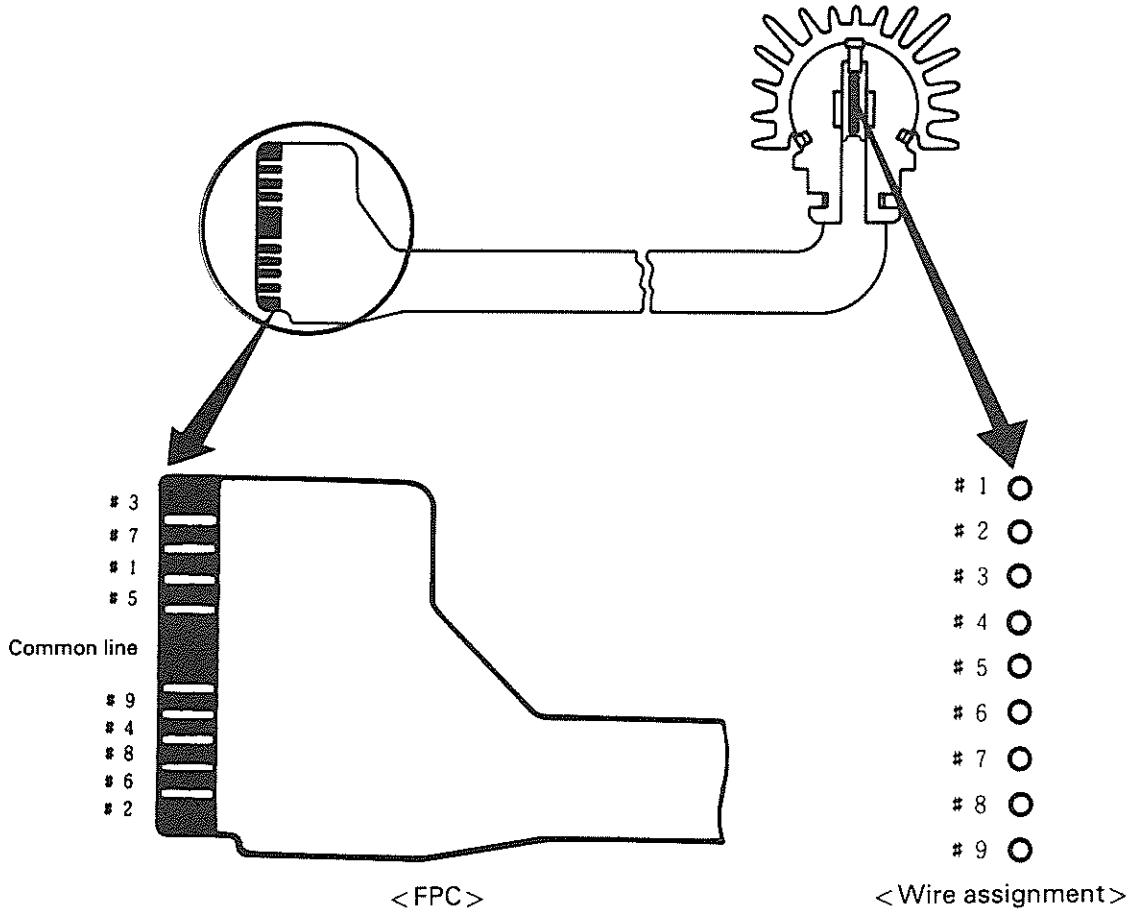
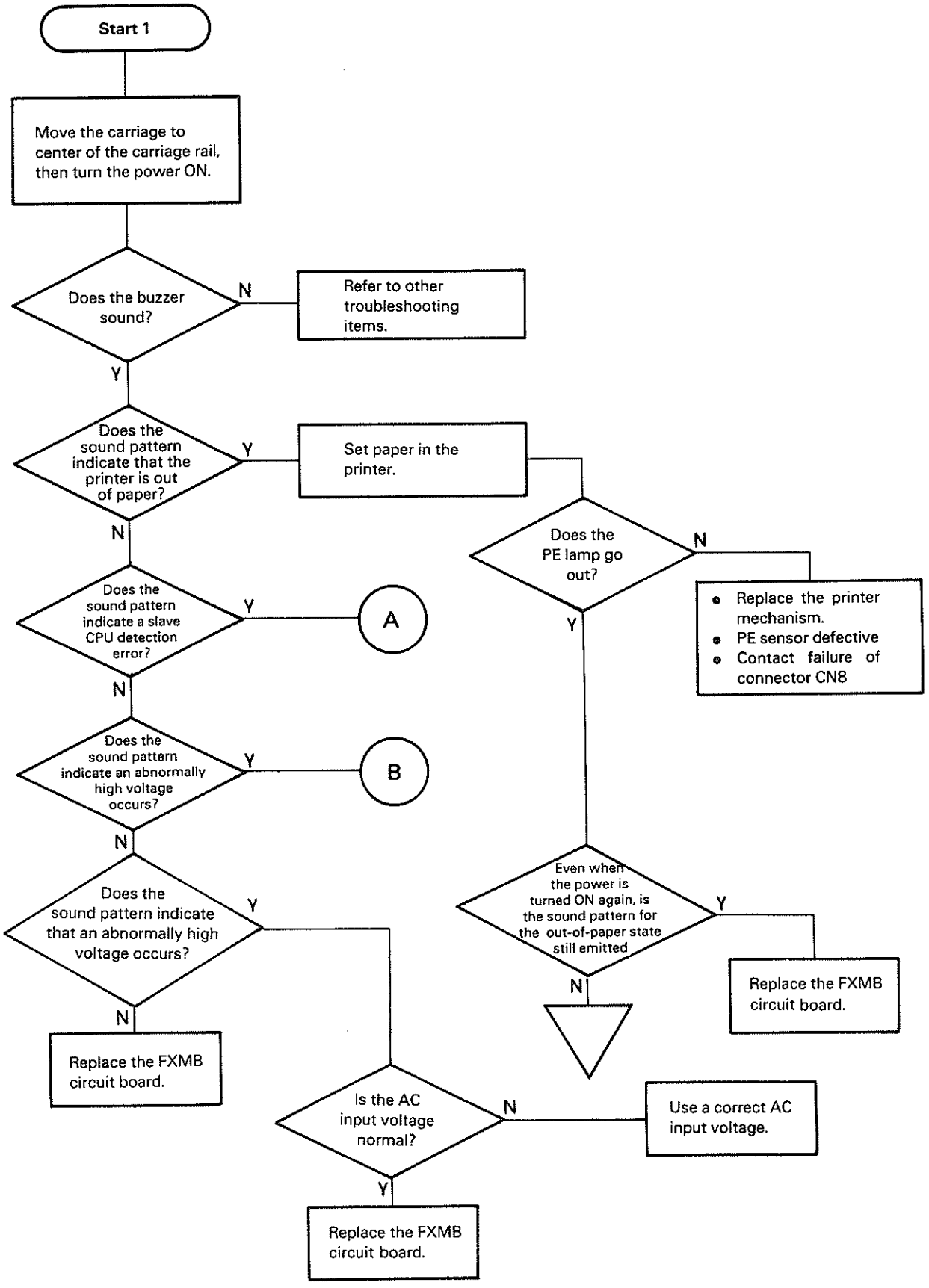


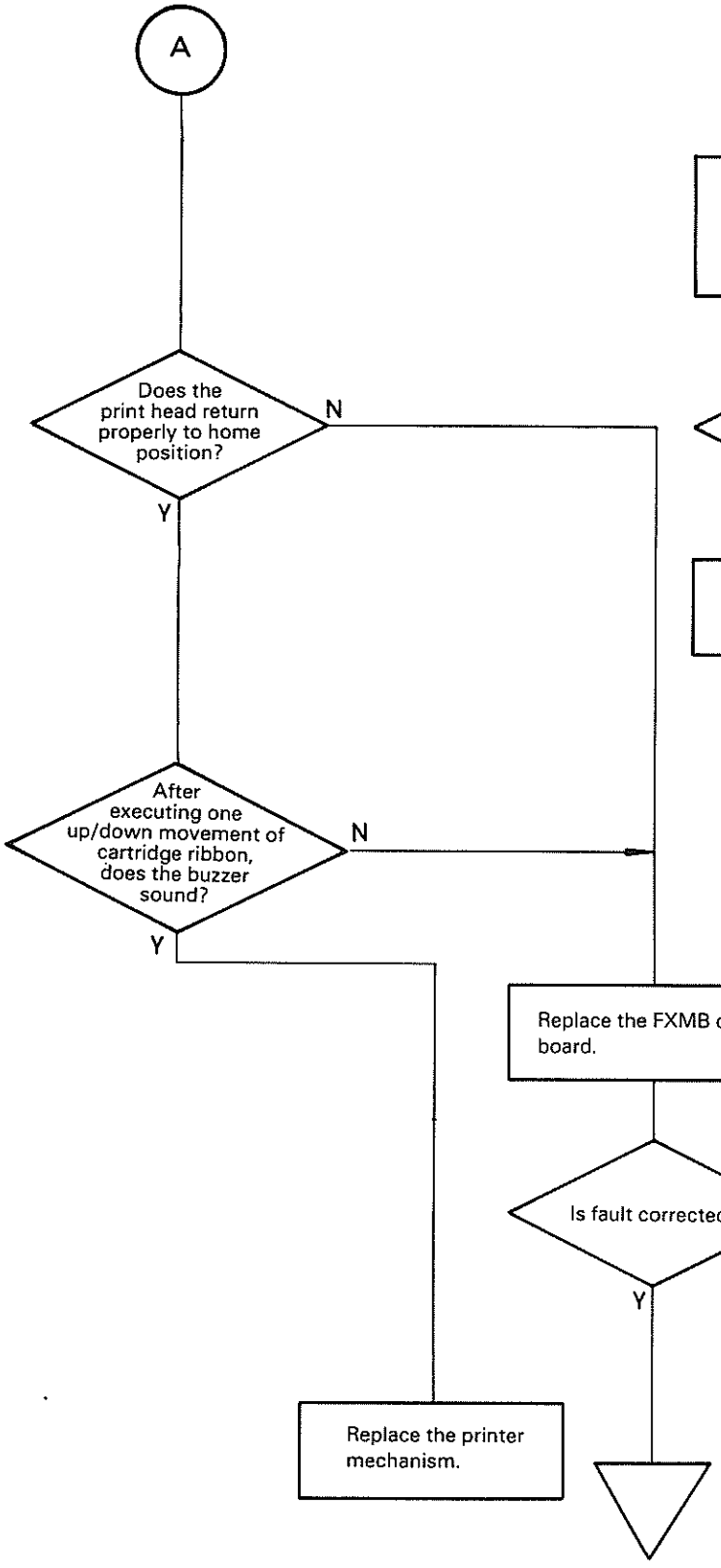
Fig. 5-1. Print Head Unit

Table 5-6. Dot Wire Resistance Value

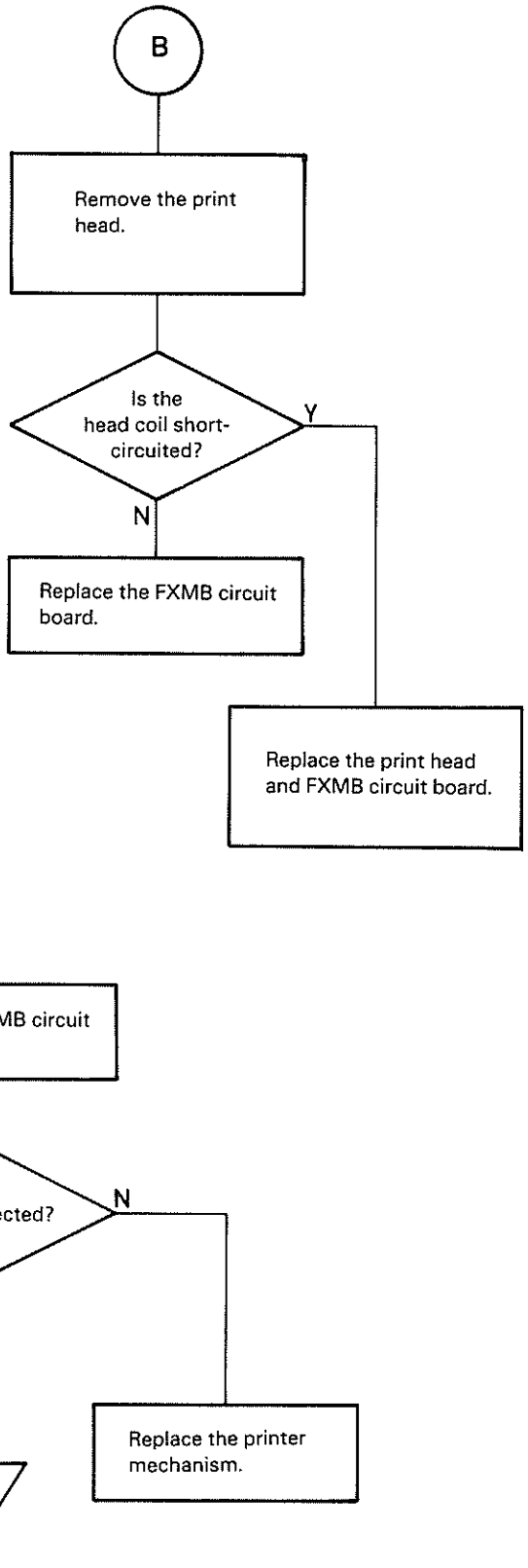
Test Leads		Resistance value
Positive lead ⊕	Negative lead ⊖	
Common line	Each dot wire	Approx. 20 ohms


Start 1
Move the carriage to center of the carriage rail, then turn the power ON.
Does the buzzer sound?
N
Refer to other troubleshooting items.
Y
Does the sound pattern indicate that the printer is out of paper?
Y
Set paper in the printer.
N
Does the sound pattern indicate a slave CPU detection error?
Y
A
N
Does the sound pattern indicate an abnormally high voltage occurs?
Y
B
N
Does the sound pattern indicate that an abnormally high voltage occurs?
Y
N
Replace the FXMB circuit board.
Is the AC input voltage normal?
N
Use a correct AC input voltage.
Y
Replace the FXMB circuit board.
Does the PE lamp go out?
N
• Replace the printer mechanism.
• PE sensor defective
• Contact failure of connector CN8
Y
Even when the power is turned ON again, is the sound pattern for the out-of-paper state still emitted
Y
Replace the FXMB circuit board.
N

Slave CPU Detection Error



Driver Transistor Short-Circuited



(2) Printer Does not Operate even with Power Switch ON

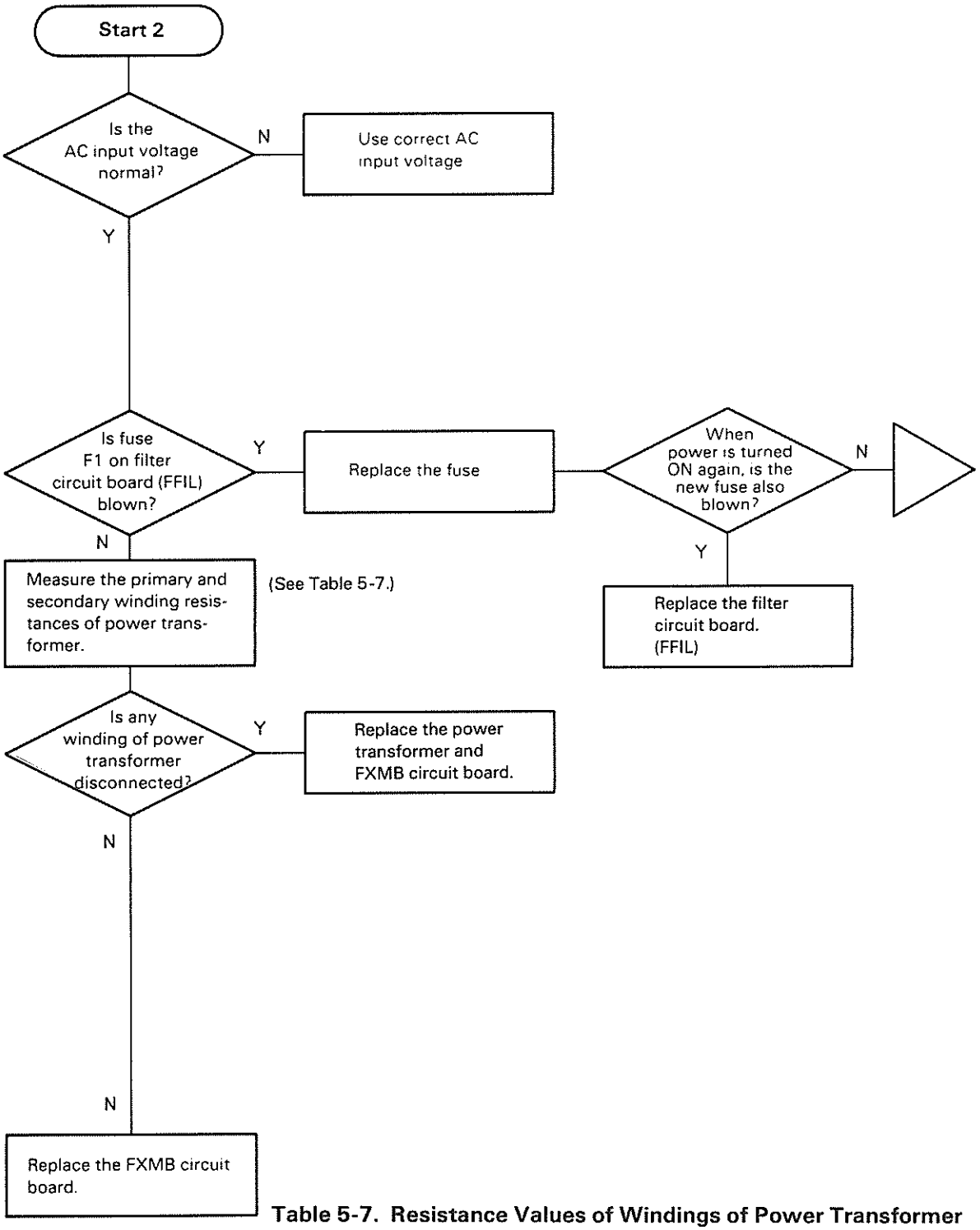
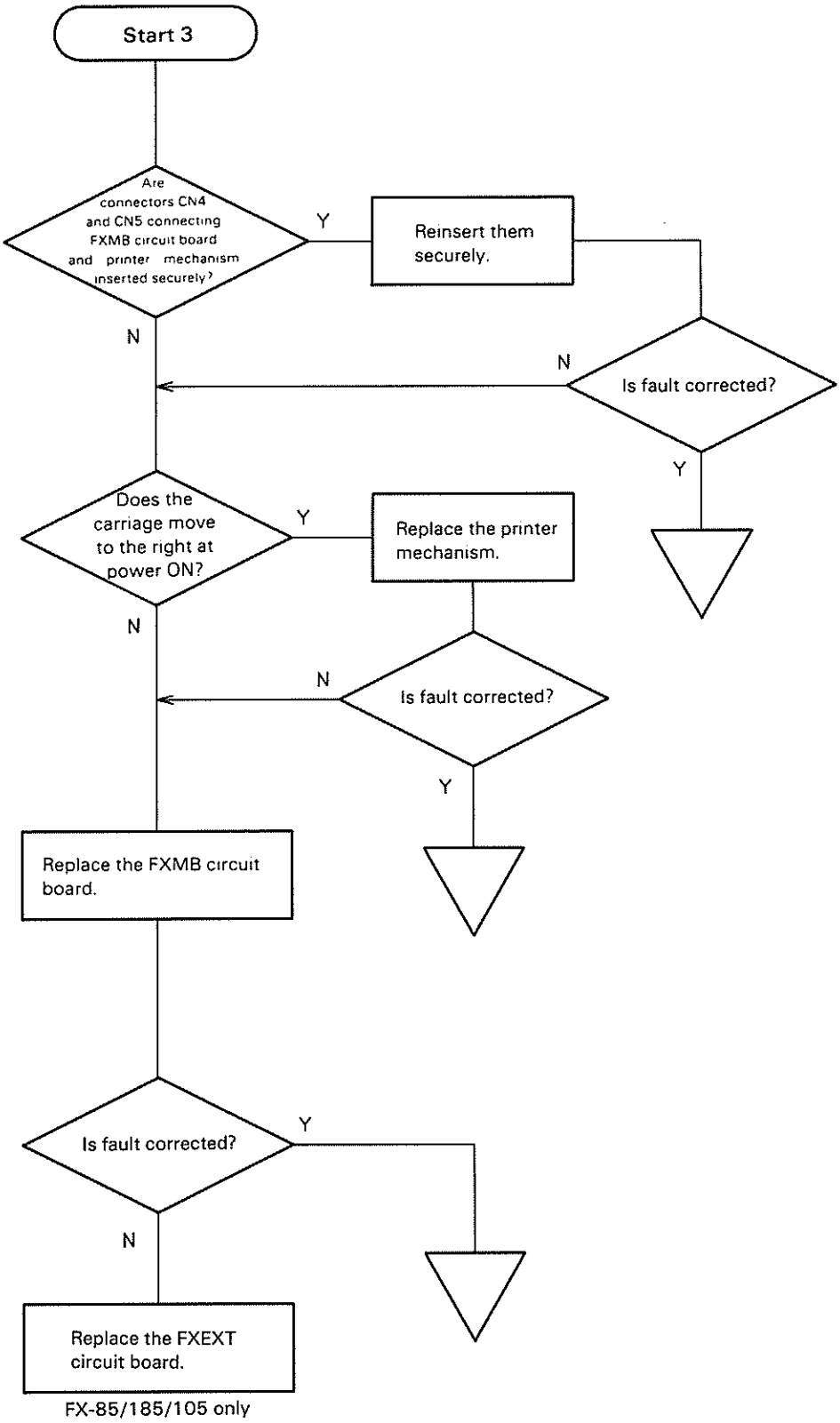


Table 5-7. Resistance Values of Windings of Power Transformer

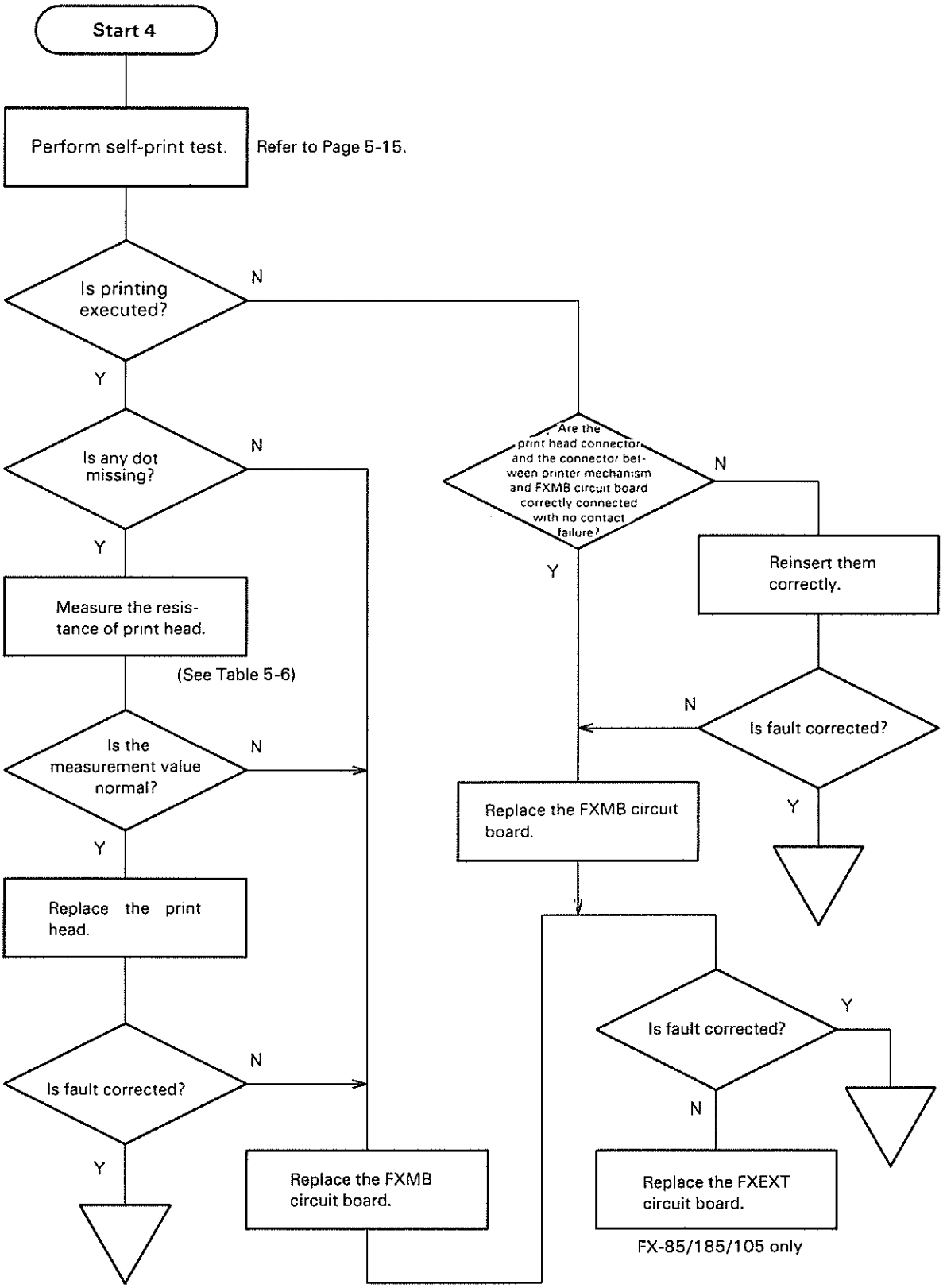
Transformer	Tester leads		Resistance value
	Positive lead ⊕	Negative lead ⊖	
Primary windings (FFIL board side)	White wire	Blue or black wire	Approx. 5 ohms
Secondary windings (FXMB board side)	Orange wire	Orange wire	Approx. 1 ohm
	Gray wire	Gray wire	Approx. 2 ohms

(3) Abnormal Operation of Carriage

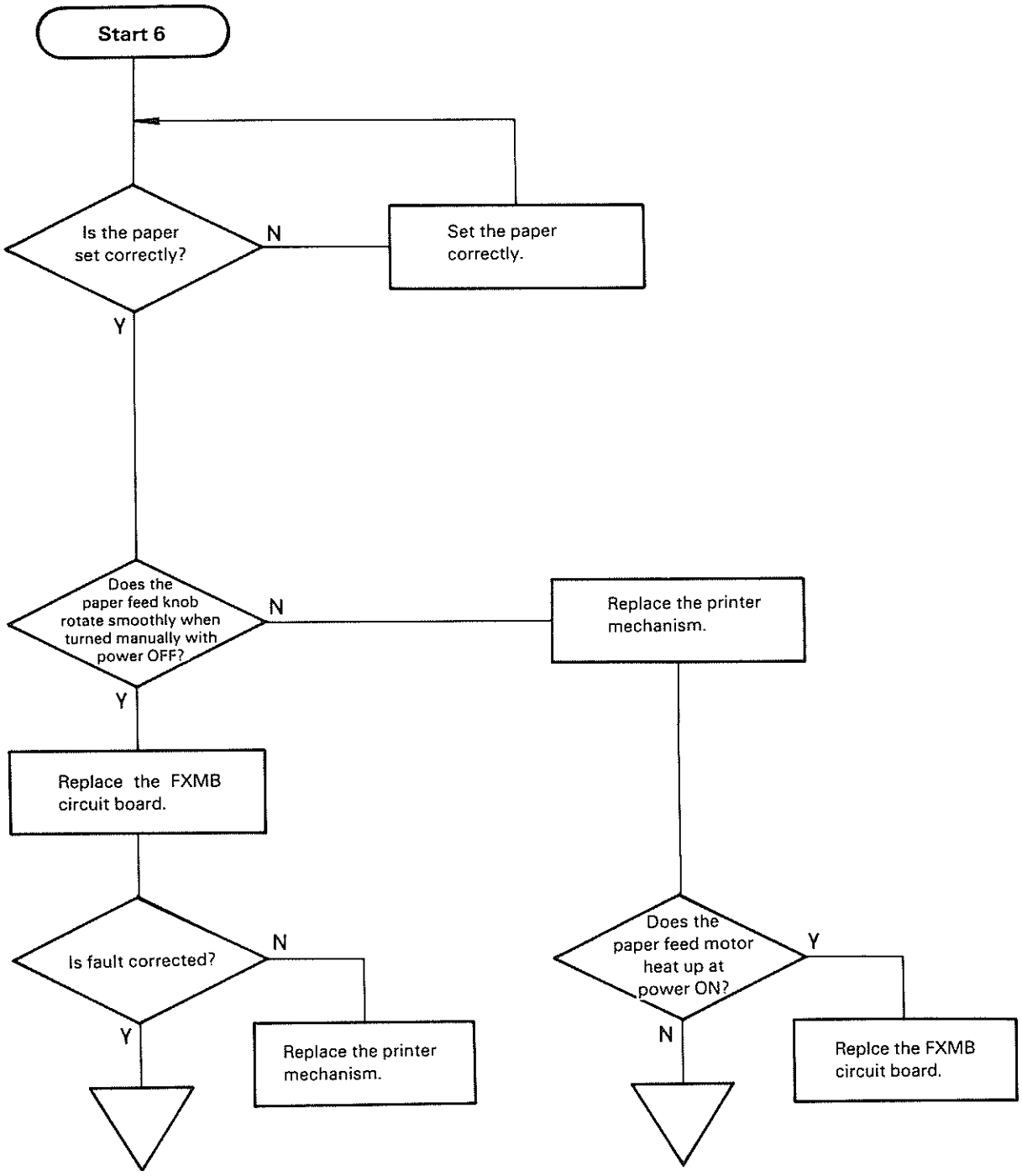


FX-85/185/105 only

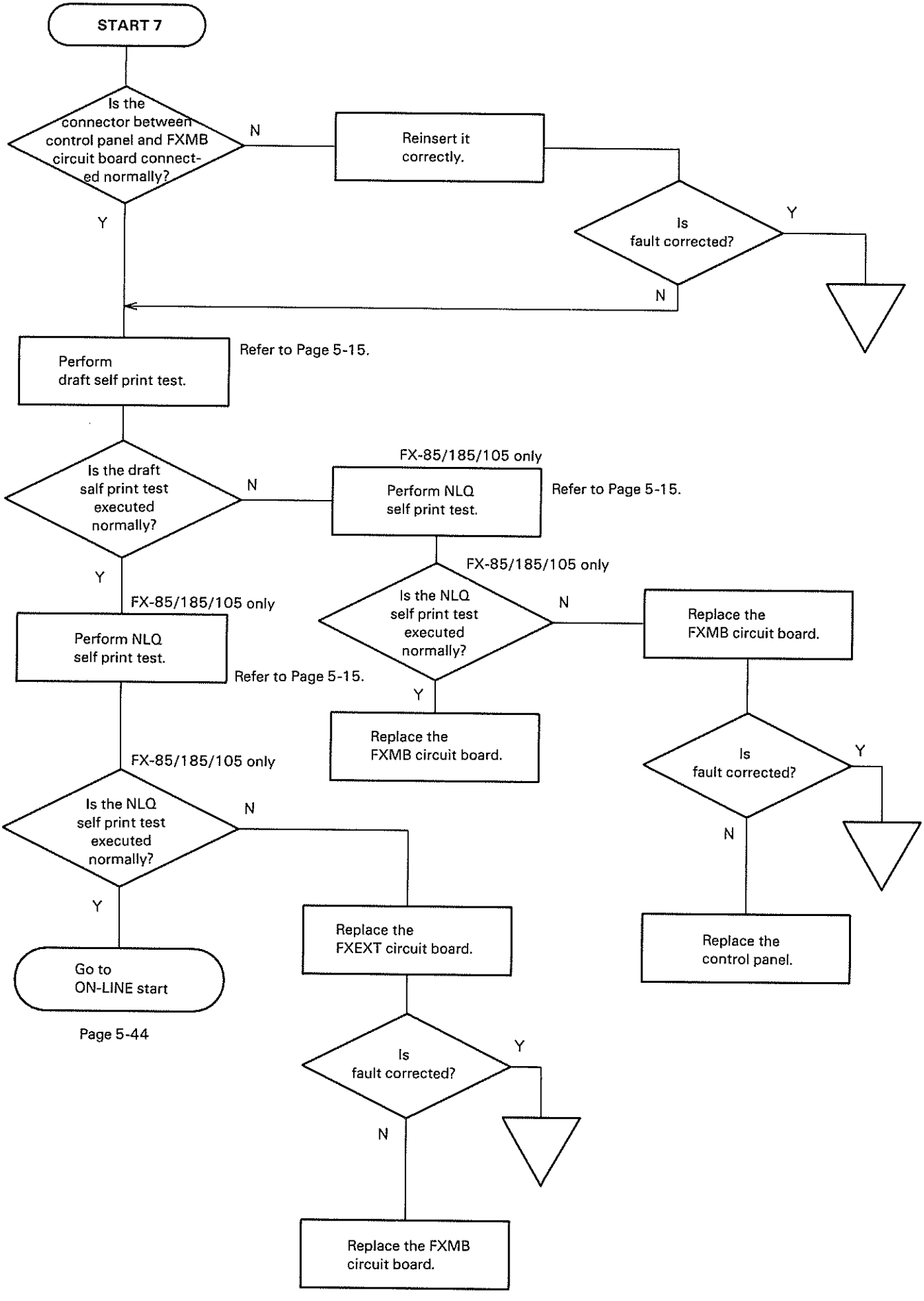
(4) Incorrect Printing (in self-print test) with Normal Carriage Operation



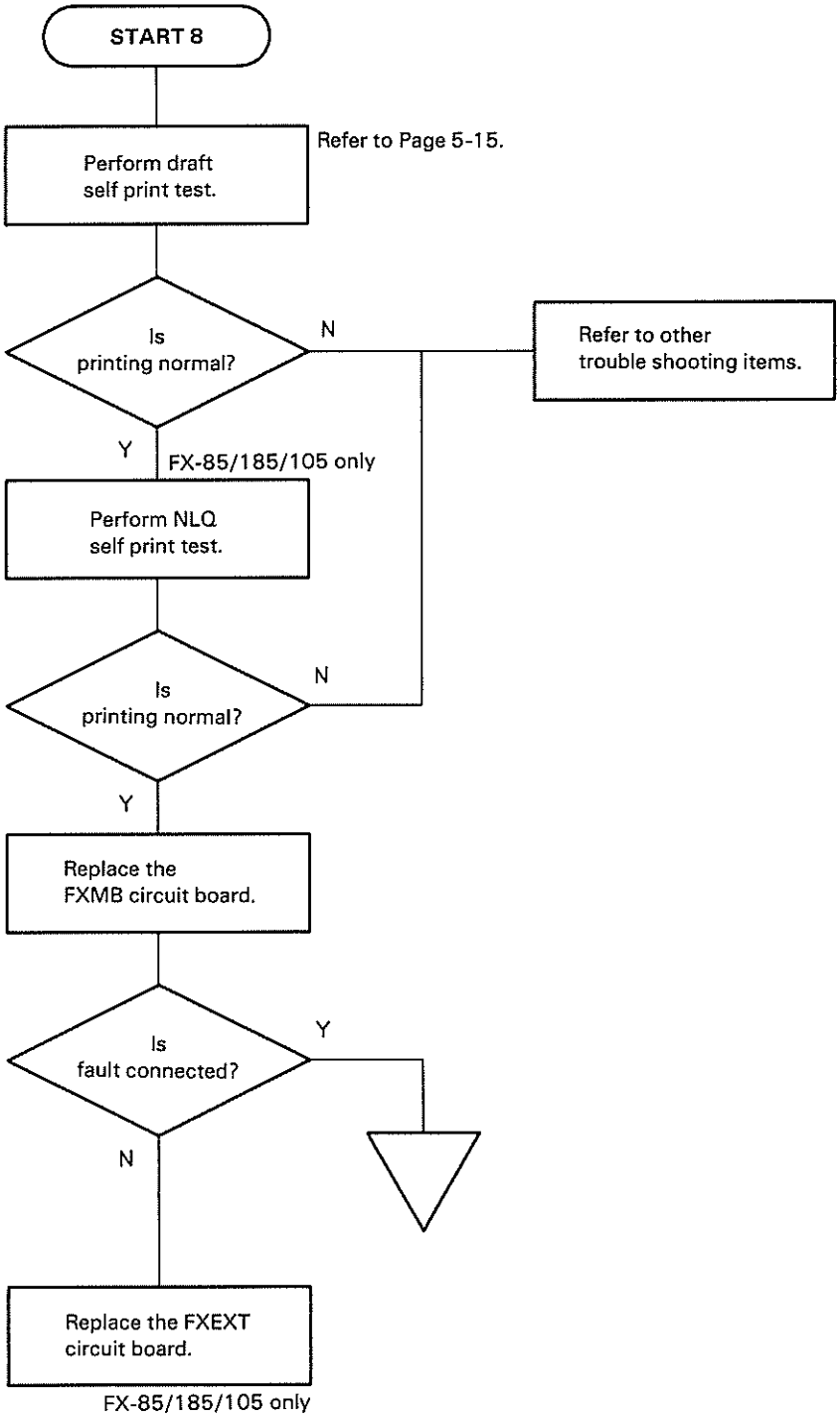
(6) Abnormal Paper Feed (with normal printing)



(1) Abnormal Operation of Control Panel



(8) Incorrect Printing in ON-LINE mode



5.3 DIAGNOSIS BY COMPONENT EVALUATION

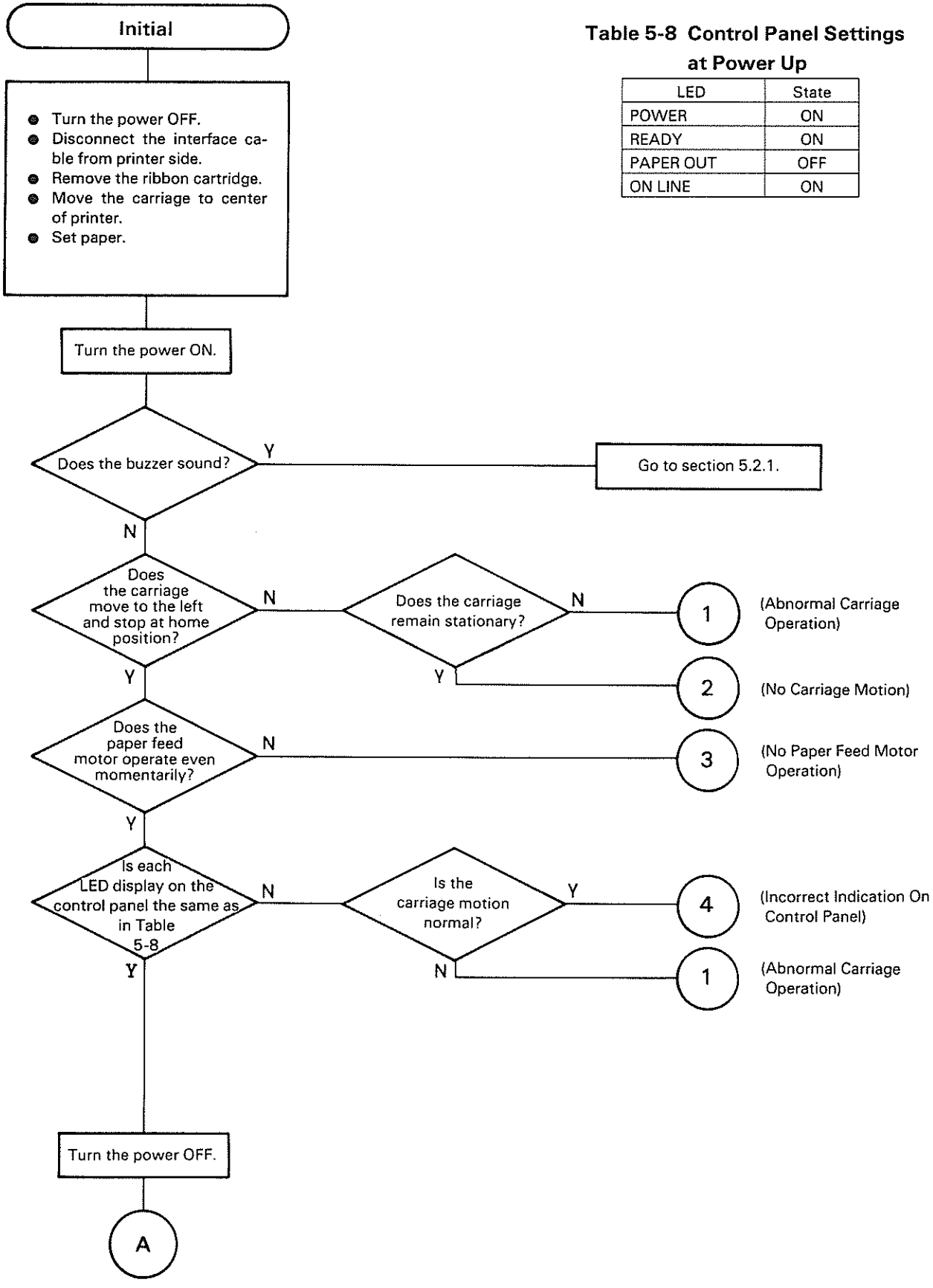
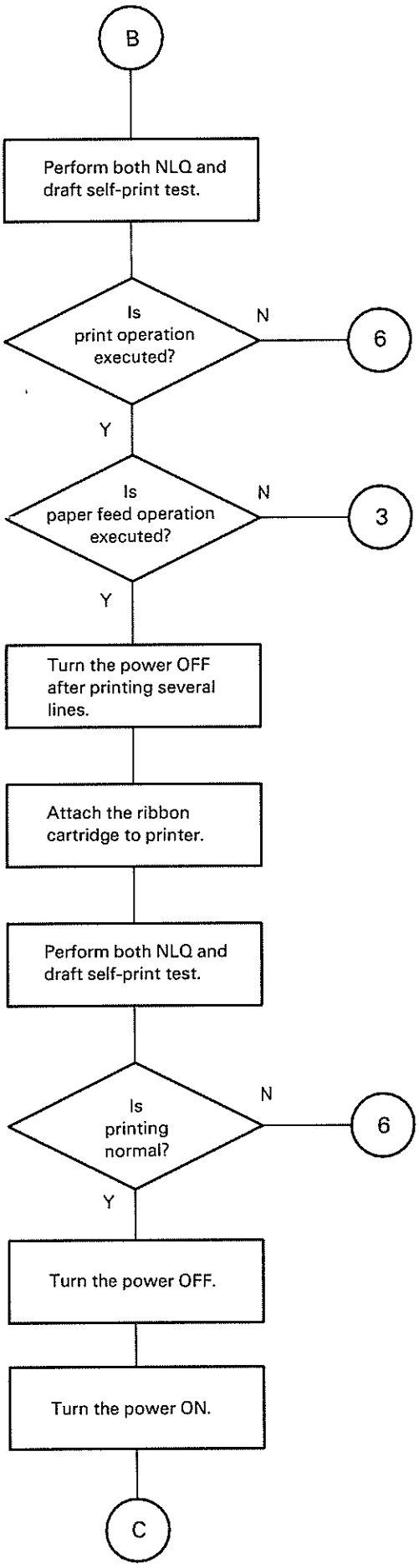


Table 5-8 Control Panel Settings at Power Up

LED	State
POWER	ON
READY	ON
PAPER OUT	OFF
ON LINE	ON



Self-print test operation

Draft printing:

1. Turn the power switch OFF.
2. While depressing the DRAFT/LF switch, turn the power switch ON.

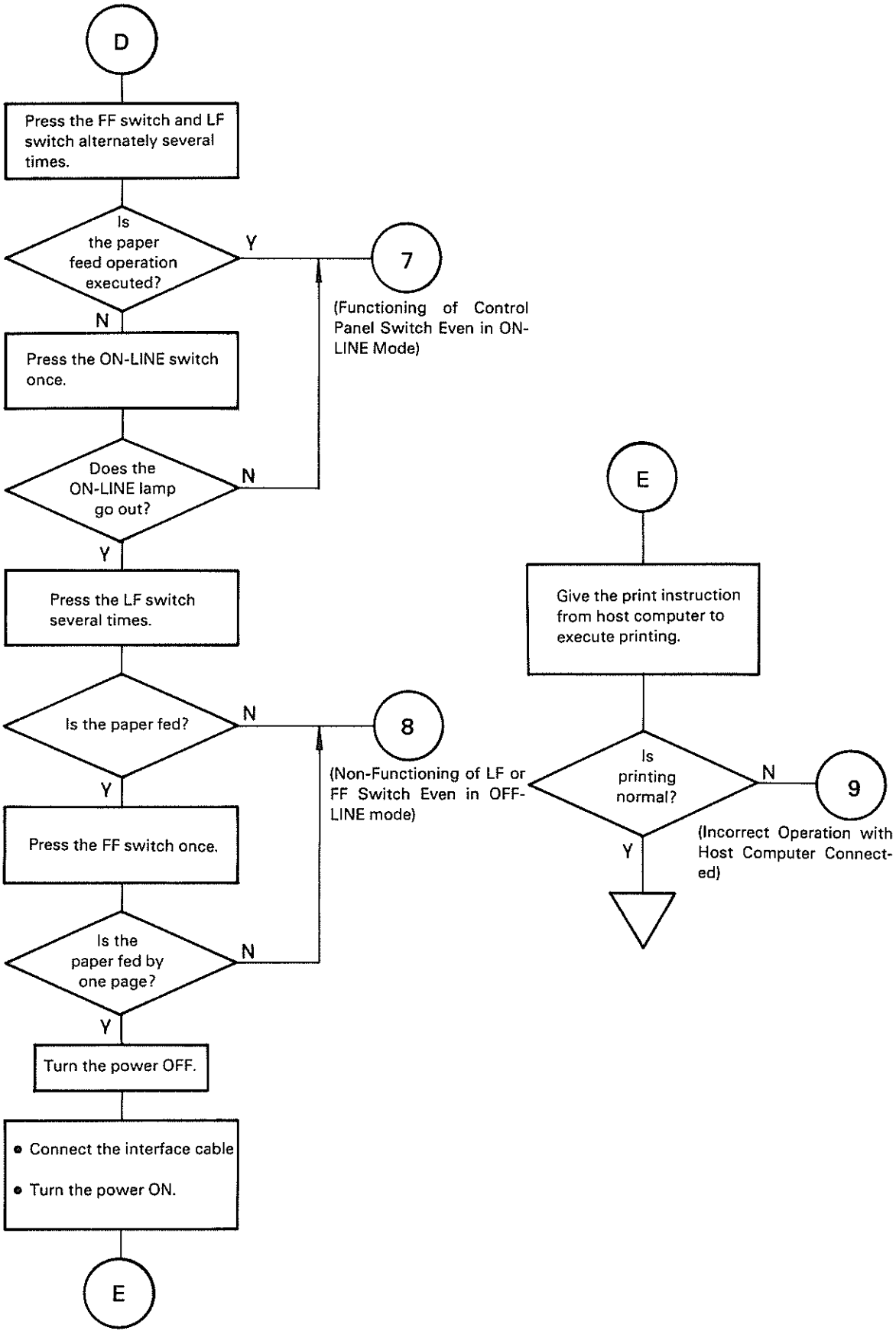
NLQ printing: FX-85/FX-185 (105) only

1. Turn the power switch OFF.
2. While depressing the NLQ/FF switch, turn the power switch ON.

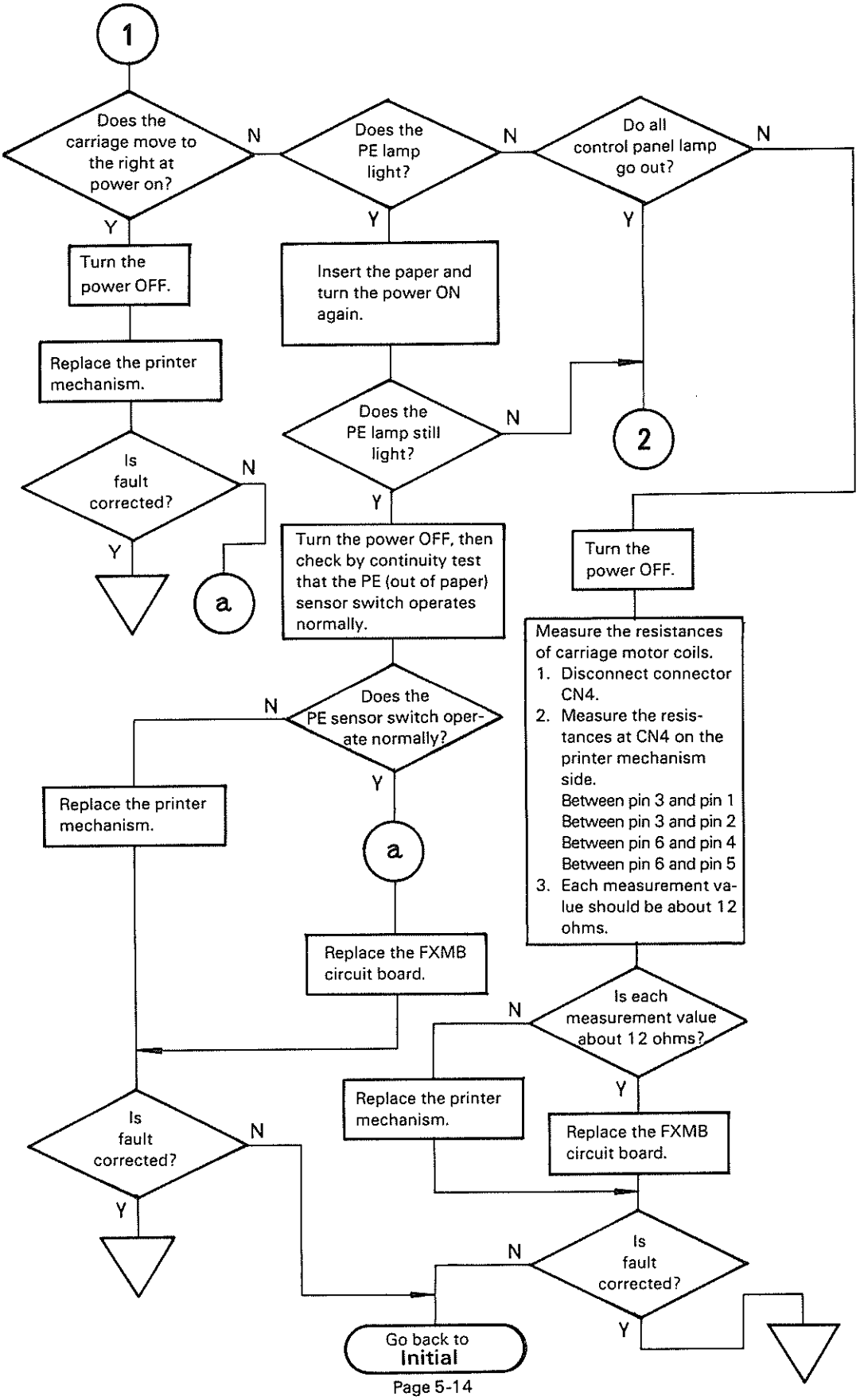
(Incorrect Printing)

(No Paper Feed Motor Operation)

(Incorrect Printing)


D
Press the FF switch and LF switch alternately several times.
Is the paper feed operation executed?
Y
7
(Functioning of Control Panel Switch Even in ON-LINE Mode)
N
Press the ON-LINE switch once.
Does the ON-LINE lamp go out?
N
Y
Press the LF switch several times.
Is the paper fed?
N
8
(Non-Functioning of LF or FF Switch Even in OFF-LINE mode)
Y
Press the FF switch once.
Is the paper fed by one page?
N
Y
Turn the power OFF.
• Connect the interface cable
• Turn the power ON.
E
E
Give the print instruction from host computer to execute printing.
Is printing normal?
N
9
(Incorrect Operation with Host Computer Connected)
Y

Carriage Does not Return to Home Position at Power ON



Page 5-14

Carriage Does not Move

No DC Voltage Appears

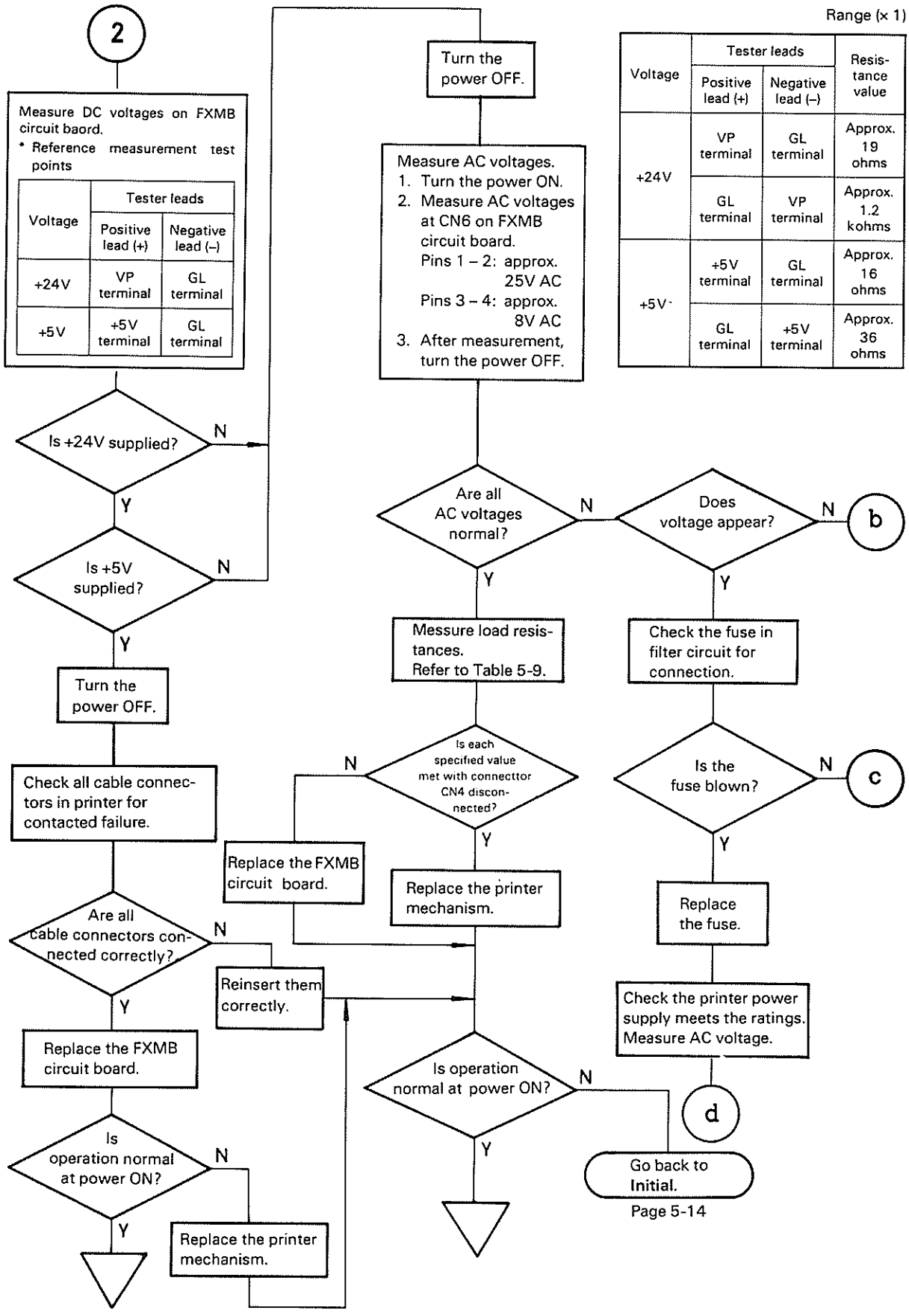
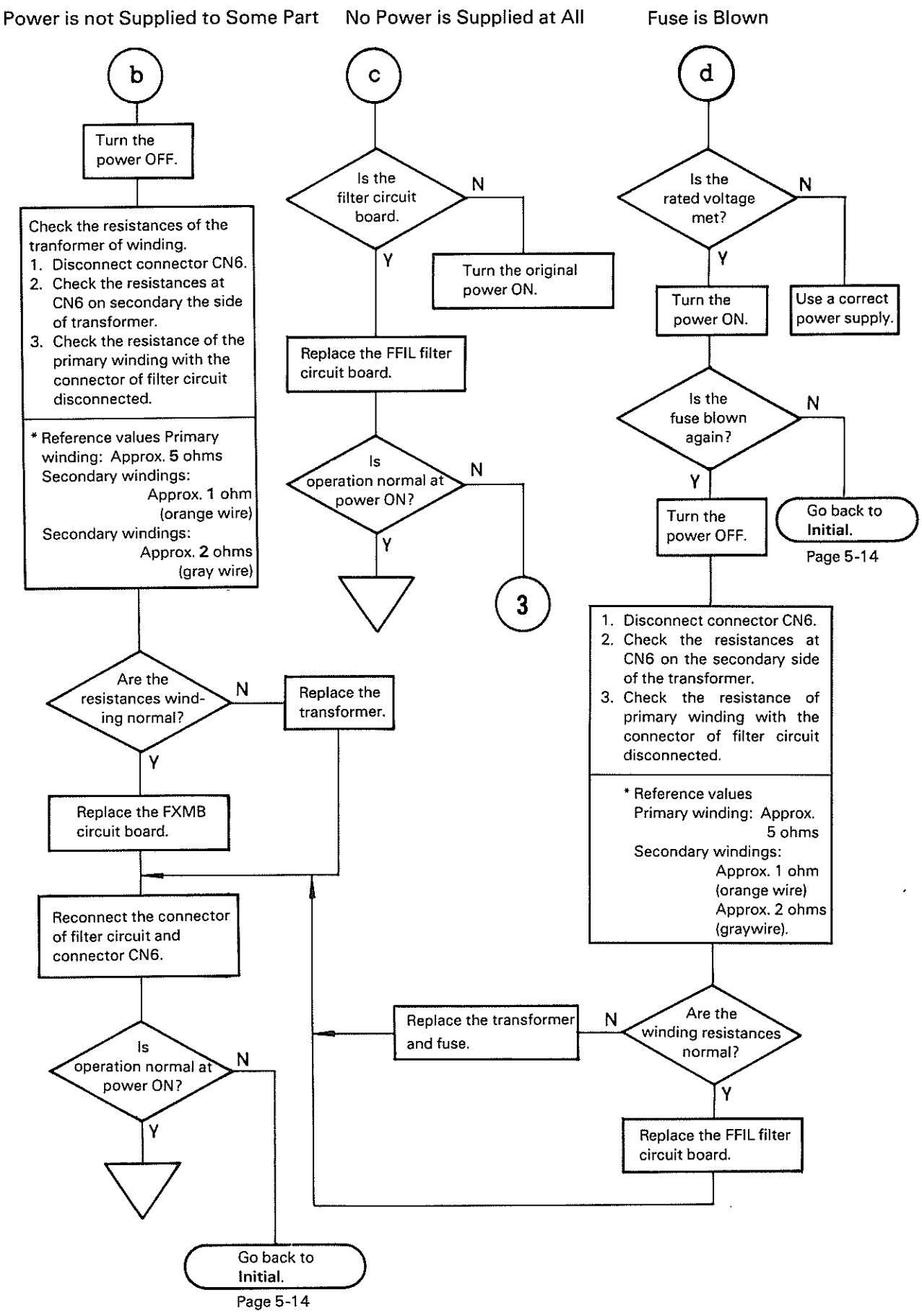


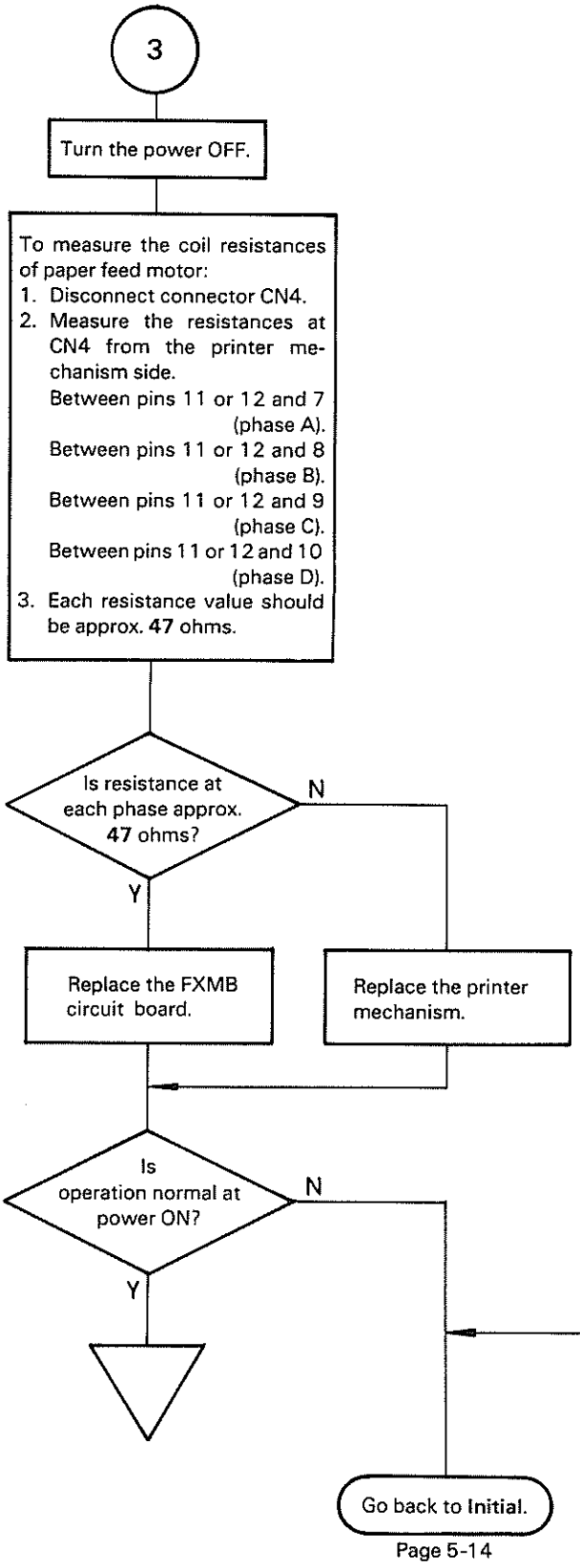
Table 5-9. Load Resistance Values

Range (× 1)

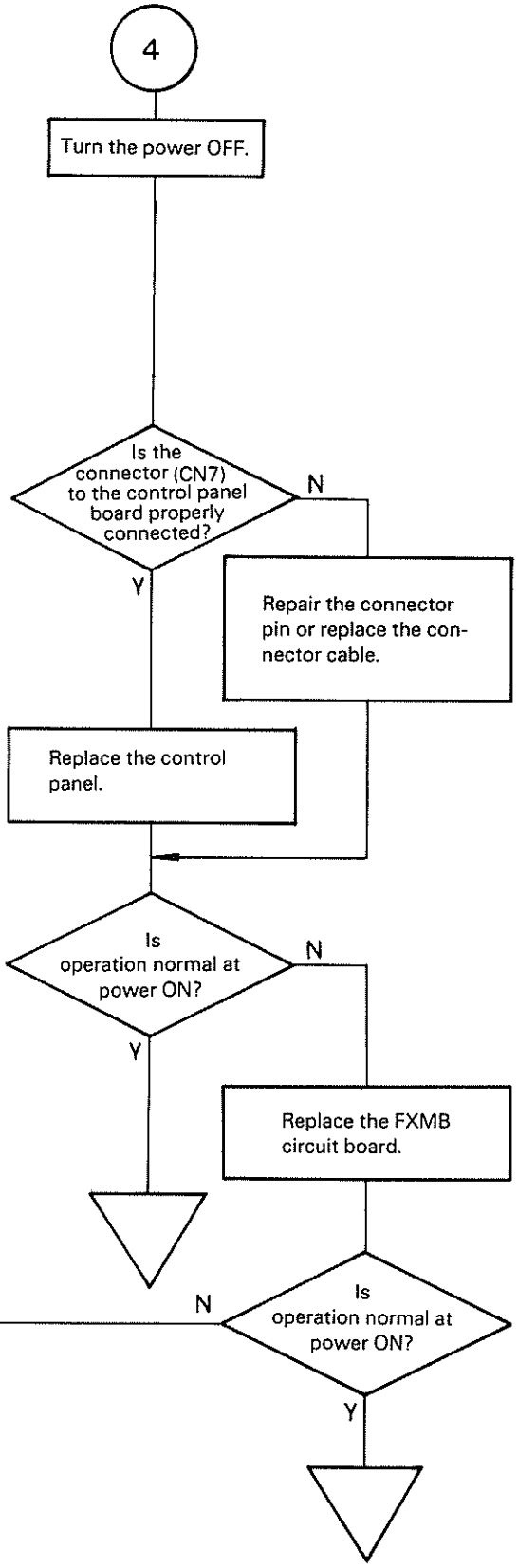
Voltage	Tester leads		Resistance value
	Positive lead (+)	Negative lead (–)	
+24V	VP terminal	GL terminal	Approx. 19 ohms
	GL terminal	VP terminal	Approx. 1.2 kohms
+5V	+5V terminal	GL terminal	Approx. 16 ohms
	GL terminal	+5V terminal	Approx. 36 ohms


Power is not Supplied to Some Part
No Power is Supplied at All
Fuse is Blown
b
Turn the power OFF.
Check the resistances of the tranformer of winding.
1. Disconnect connector CN6.
2. Check the resistances at CN6 on secondary the side of transformer.
3. Check the resistance of the primary winding with the connector of filter circuit disconnected.
* Reference values Primary winding: Approx. 5 ohms
Secondary windings: Approx. 1 ohm (orange wire)
Secondary windings: Approx. 2 ohms (gray wire)
Are the resistances winding normal?
N
Replace the transformer.
Y
Replace the FXMB circuit board.
Reconnect the connector of filter circuit and connector CN6.
Is operation normal at power ON?
N
Y
Go back to Initial.
Page 5-14
c
Is the filter circuit board.
N
Turn the original power ON.
Y
Replace the FFIL filter circuit board.
Is operation normal at power ON?
N
Y
3
d
Is the rated voltage met?
N
Use a correct power supply.
Y
Turn the power ON.
Is the fuse blown again?
N
Go back to Initial.
Page 5-14
Y
Turn the power OFF.
1. Disconnect connector CN6.
2. Check the resistances at CN6 on the secondary side of the transformer.
3. Check the resistance of primary winding with the connector of filter circuit disconnected.
* Reference values
Primary winding: Approx. 5 ohms
Secondary windings: Approx. 1 ohm (orange wire)
Approx. 2 ohms (graywire).
Are the winding resistances normal?
N
Replace the transformer and fuse.
Y
Replace the FFIL filter circuit board.

Power Feed Motor does not Operate

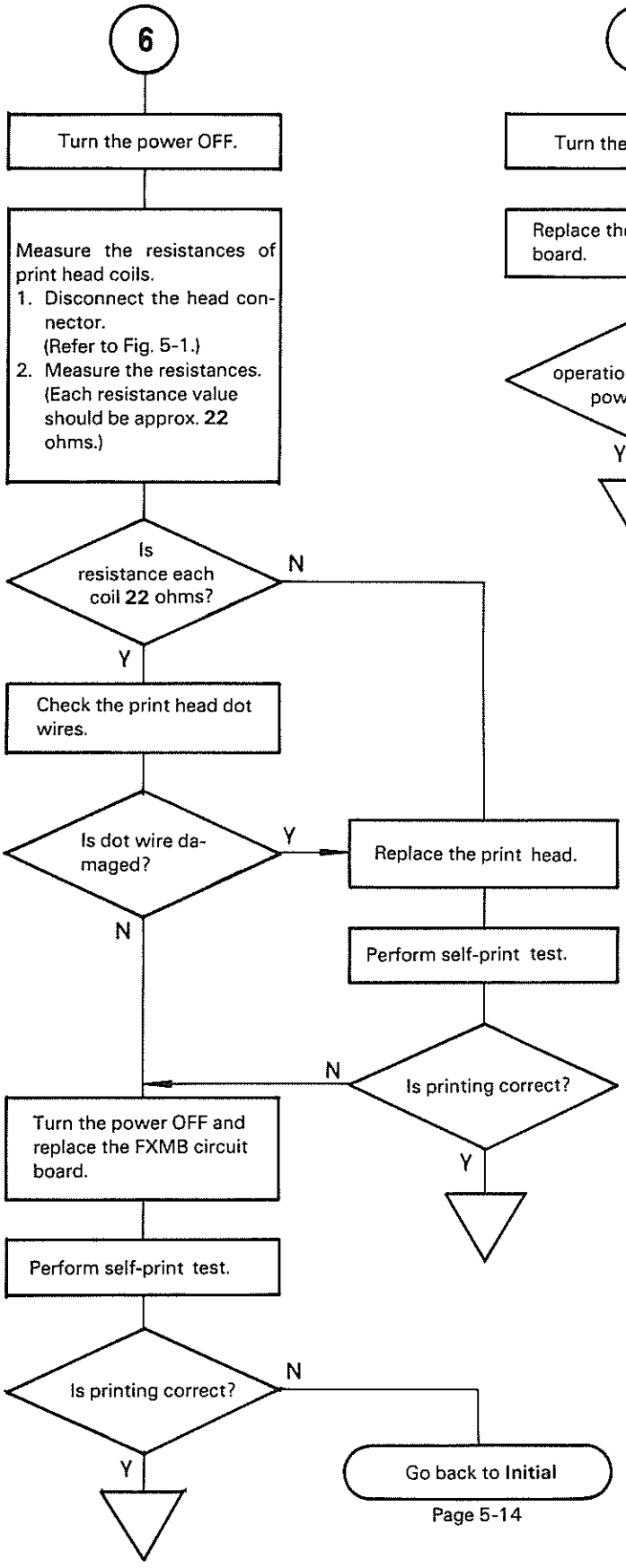


Indication on Control Panel is Incorrect.

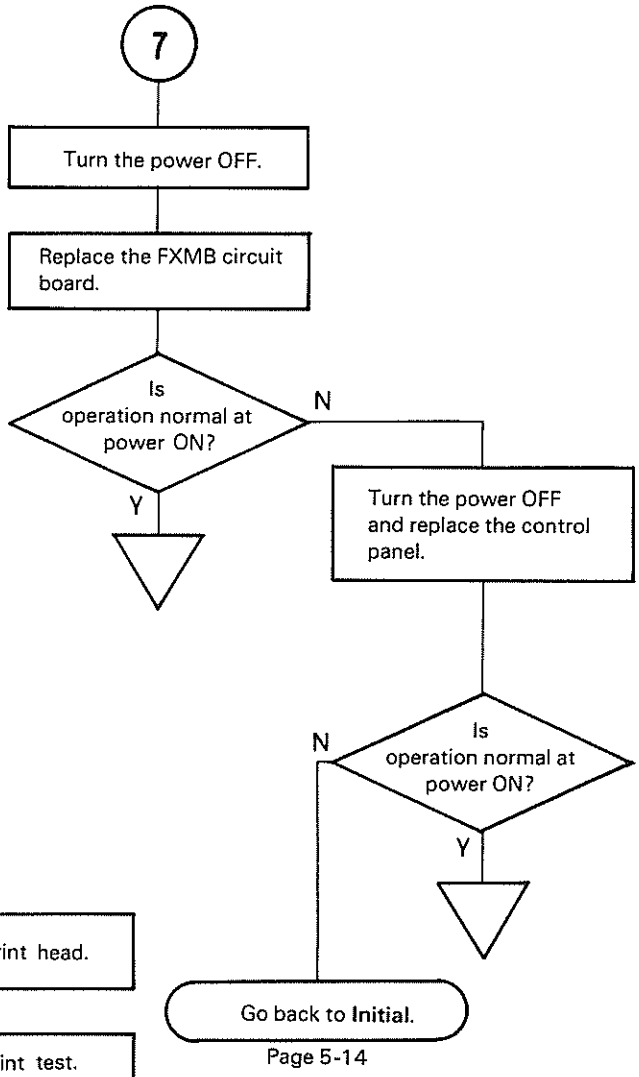


Page 5-14

Printing is Incorrect

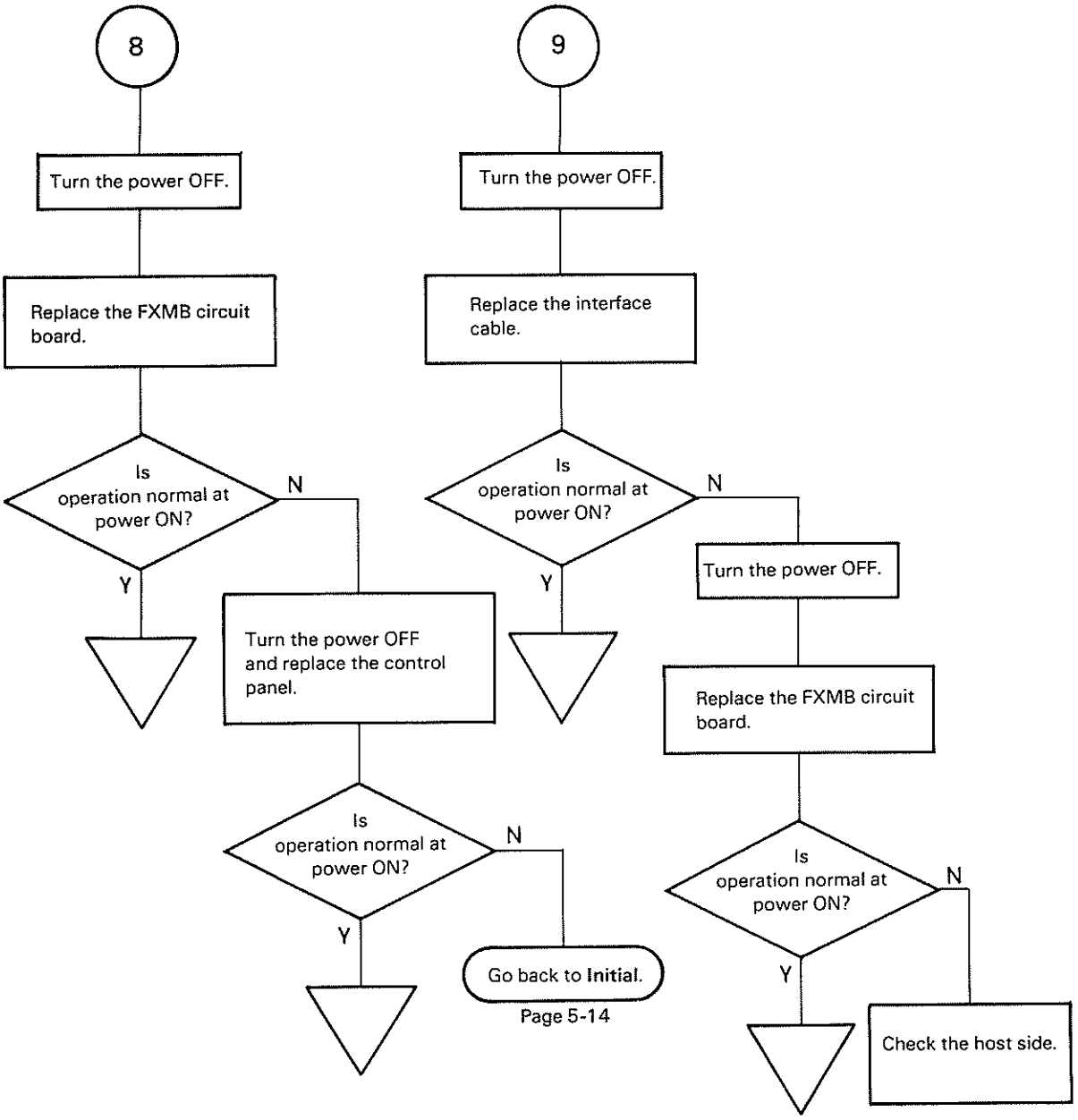


Control Panel Function in ON-LINE Mode



LF and FF Switches Do not Operate in OFF-LINE Mode.

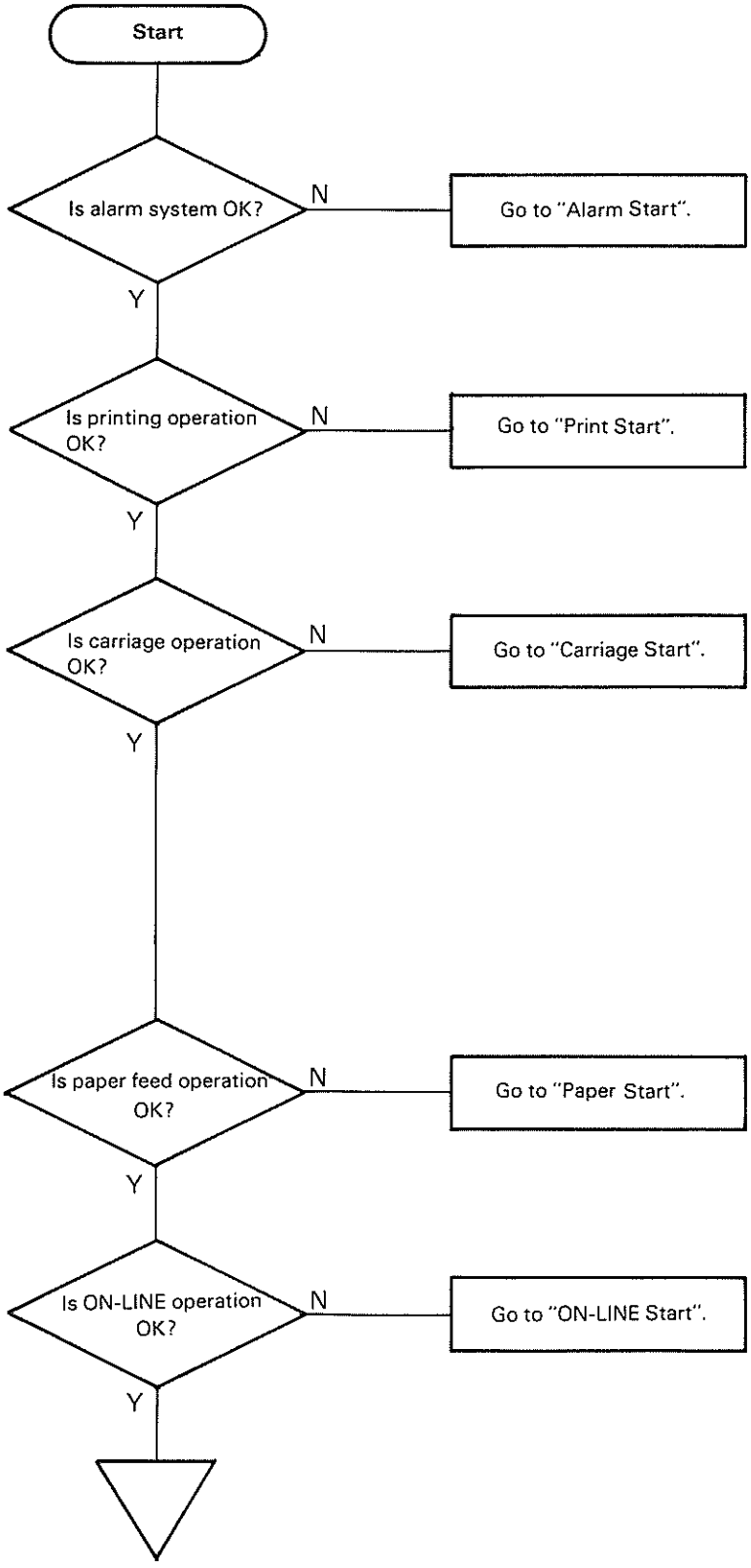
Operation is Incorrect with Host Computer Connected.

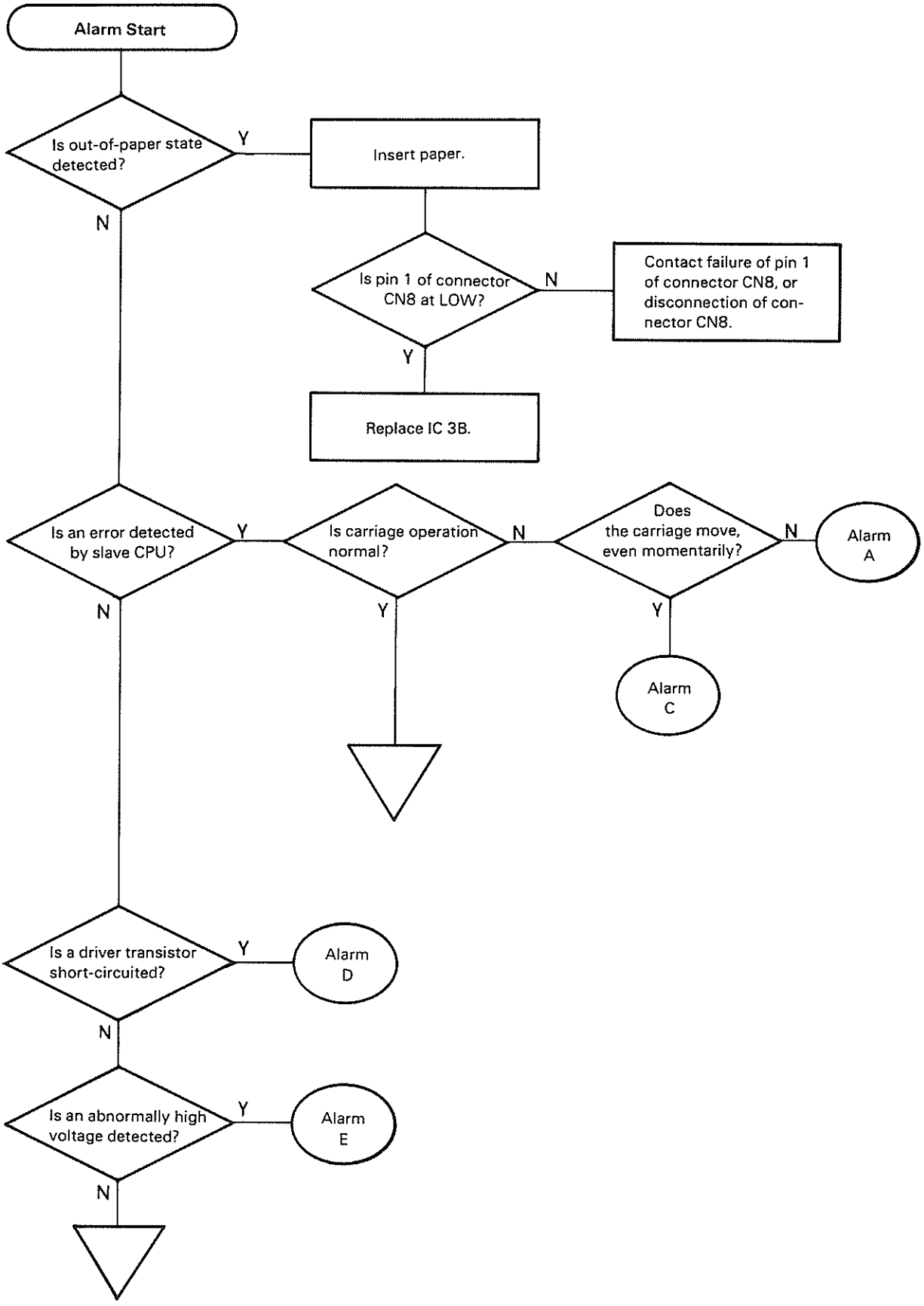


5.4 PROBLEM DIAGNOSIS BY CIRCUIT EVALUATION

5.4.1 TROUBLESHOOTING FOR FXMB CIRCUIT BOARD

The following test procedures require use of an oscilloscope or a synchroscope.




Alarm Start
Is out-of-paper state detected?
Y
Insert paper.
N
Is pin 1 of connector CN8 at LOW?
N
Contact failure of pin 1 of connector CN8, or disconnection of connector CN8.
Y
Replace IC 3B.
Is an error detected by slave CPU?
Y
Is carriage operation normal?
N
Does the carriage move, even momentarily?
N
Alarm A
N
Y
Y
Alarm C
Is a driver transistor short-circuited?
Y
Alarm D
N
Is an abnormally high voltage detected?
Y
Alarm E
N

Carriage Does not Move at all.

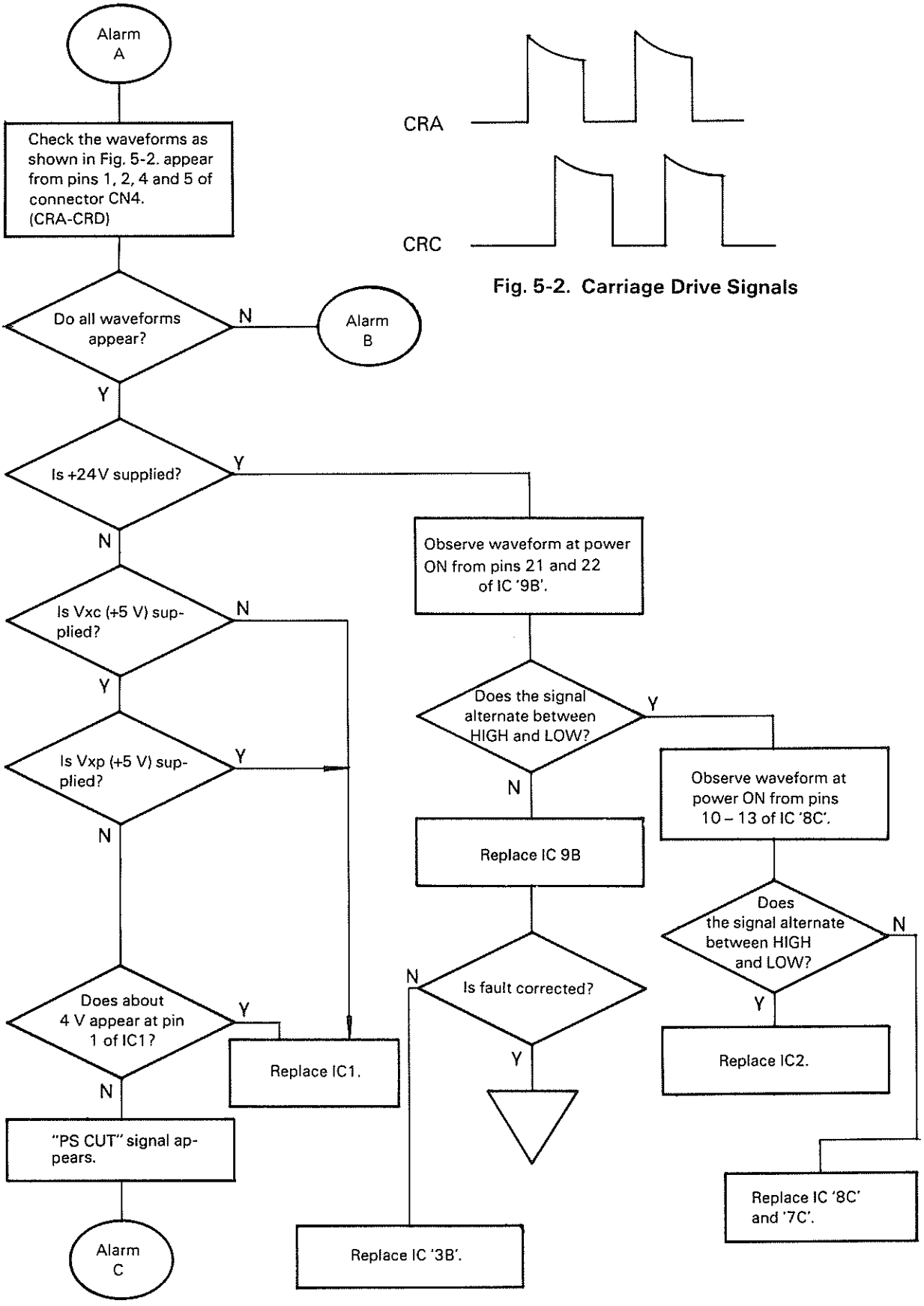
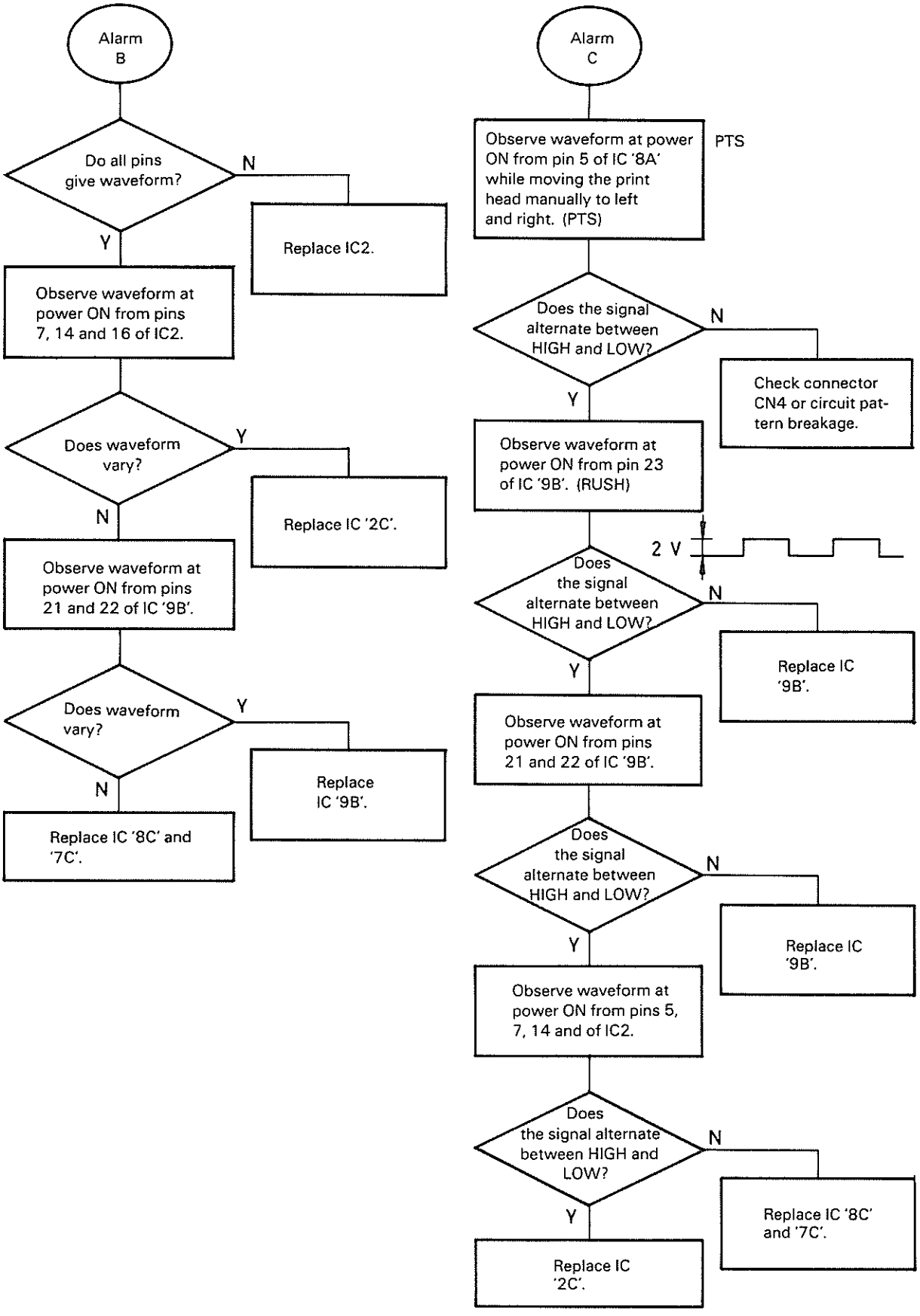


Fig. 5-2. Carriage Drive Signals

Carriage Does not Move with "PSCUT" Signal.

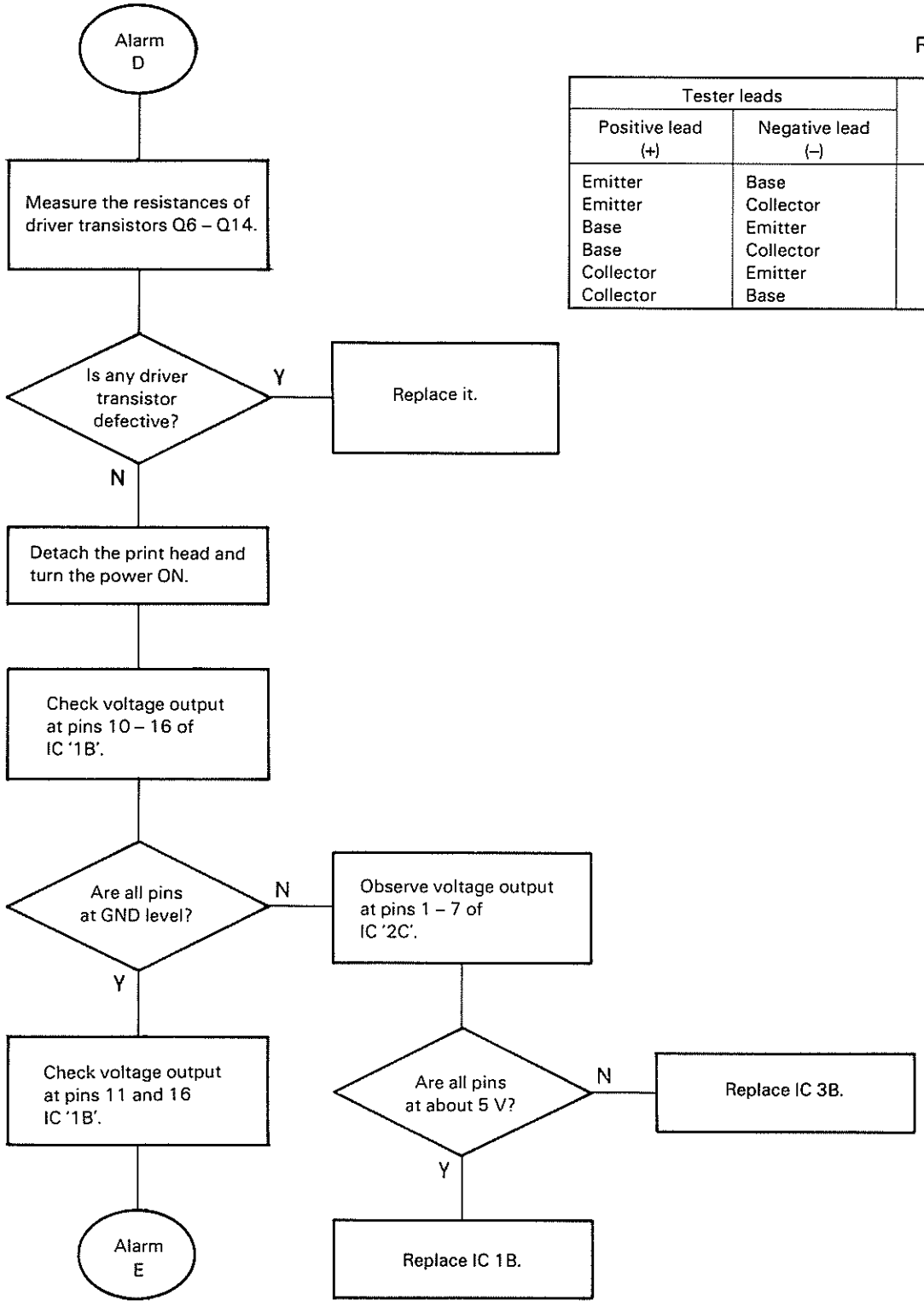


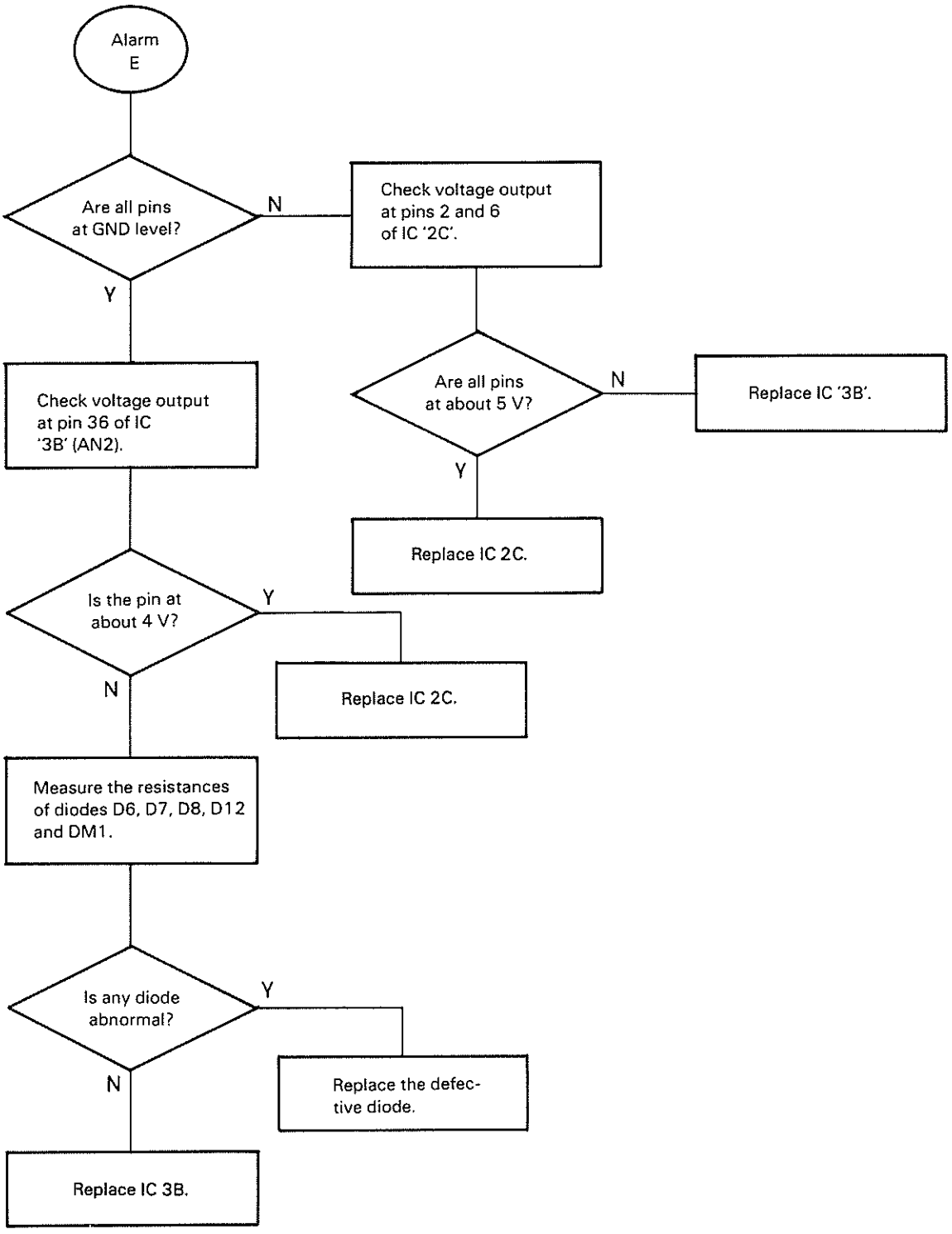
Driver Transistor in Short-Circuited

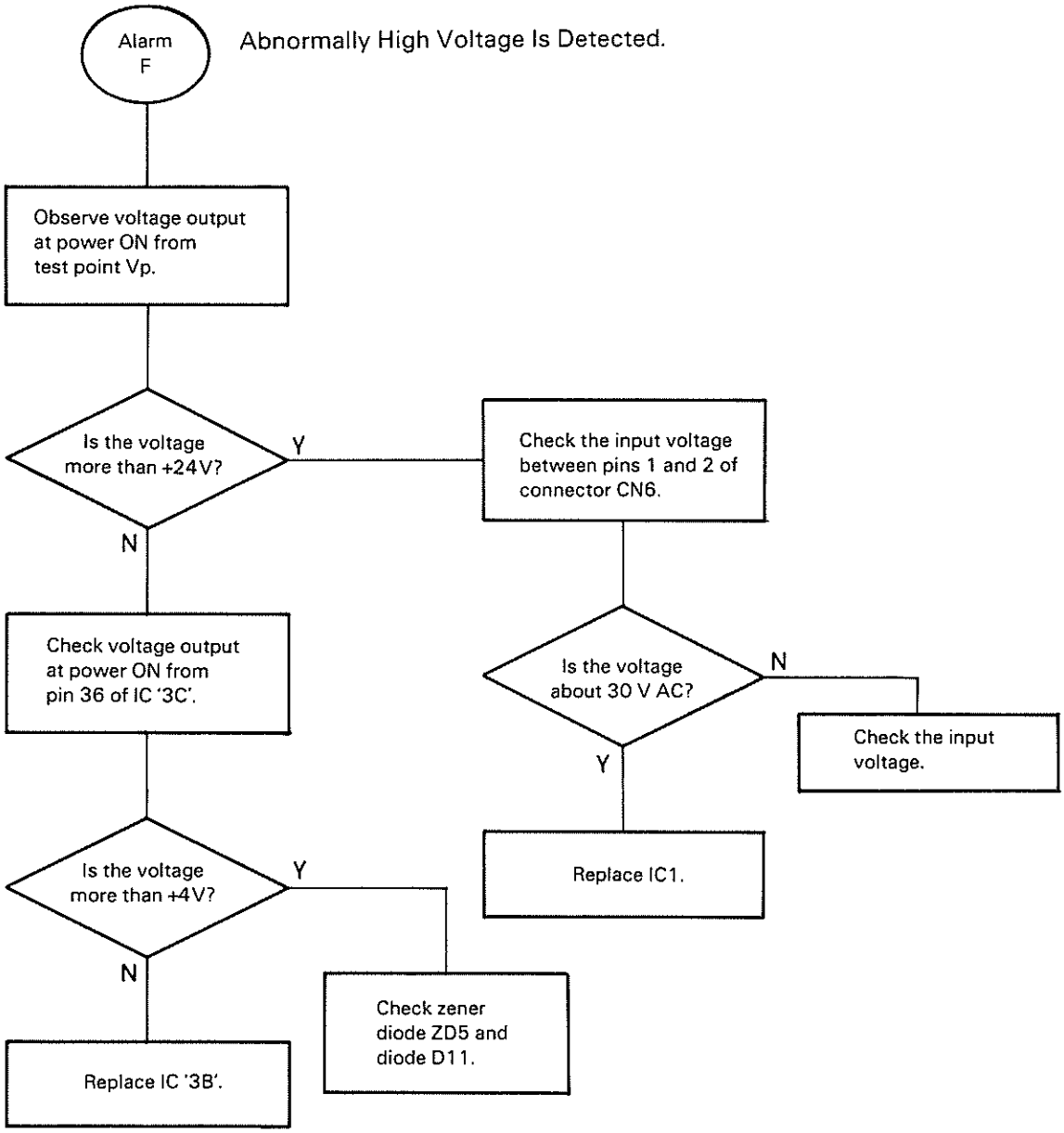
Table 5-10. Resistance Values of Driver Transistor

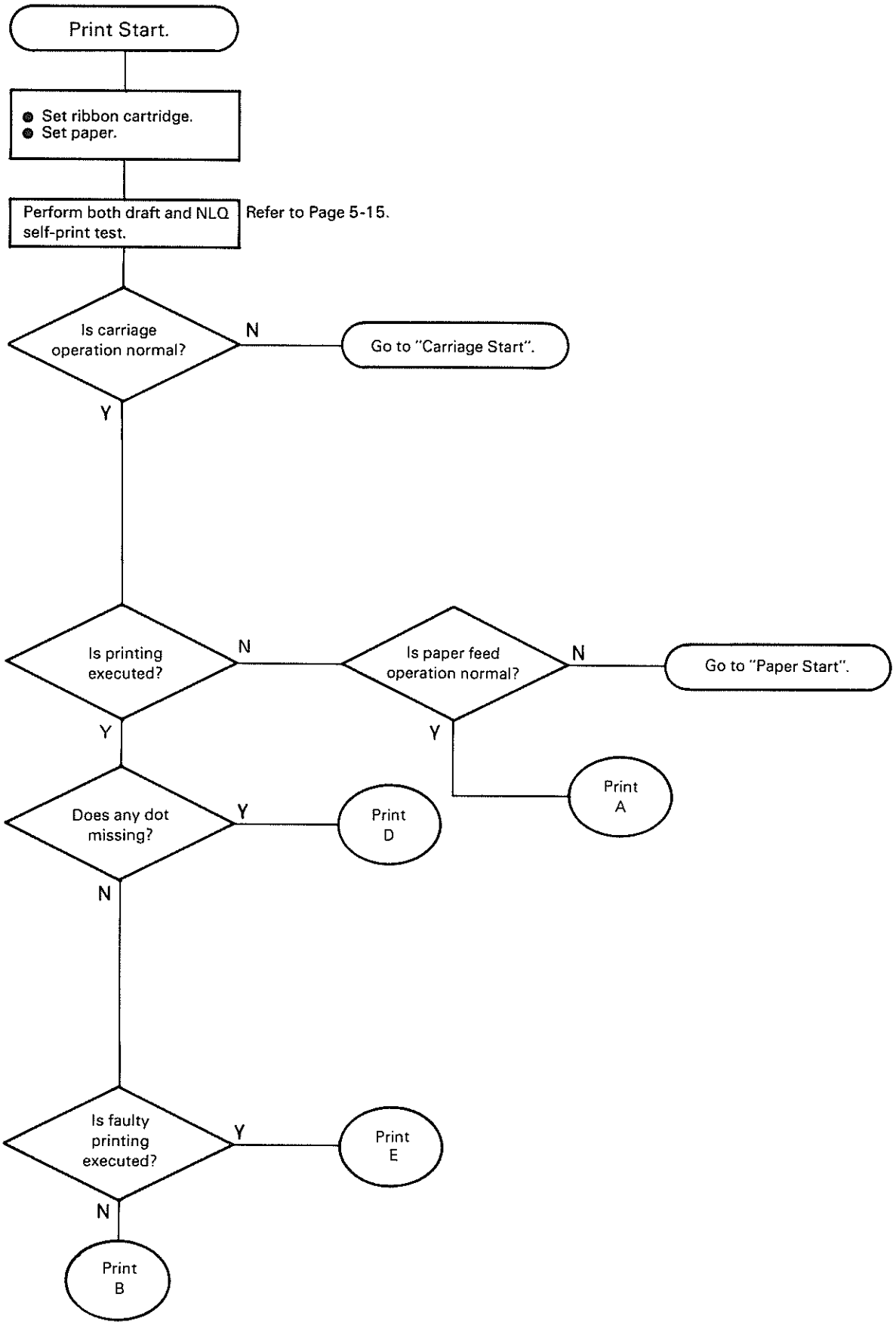
Range (× 100)

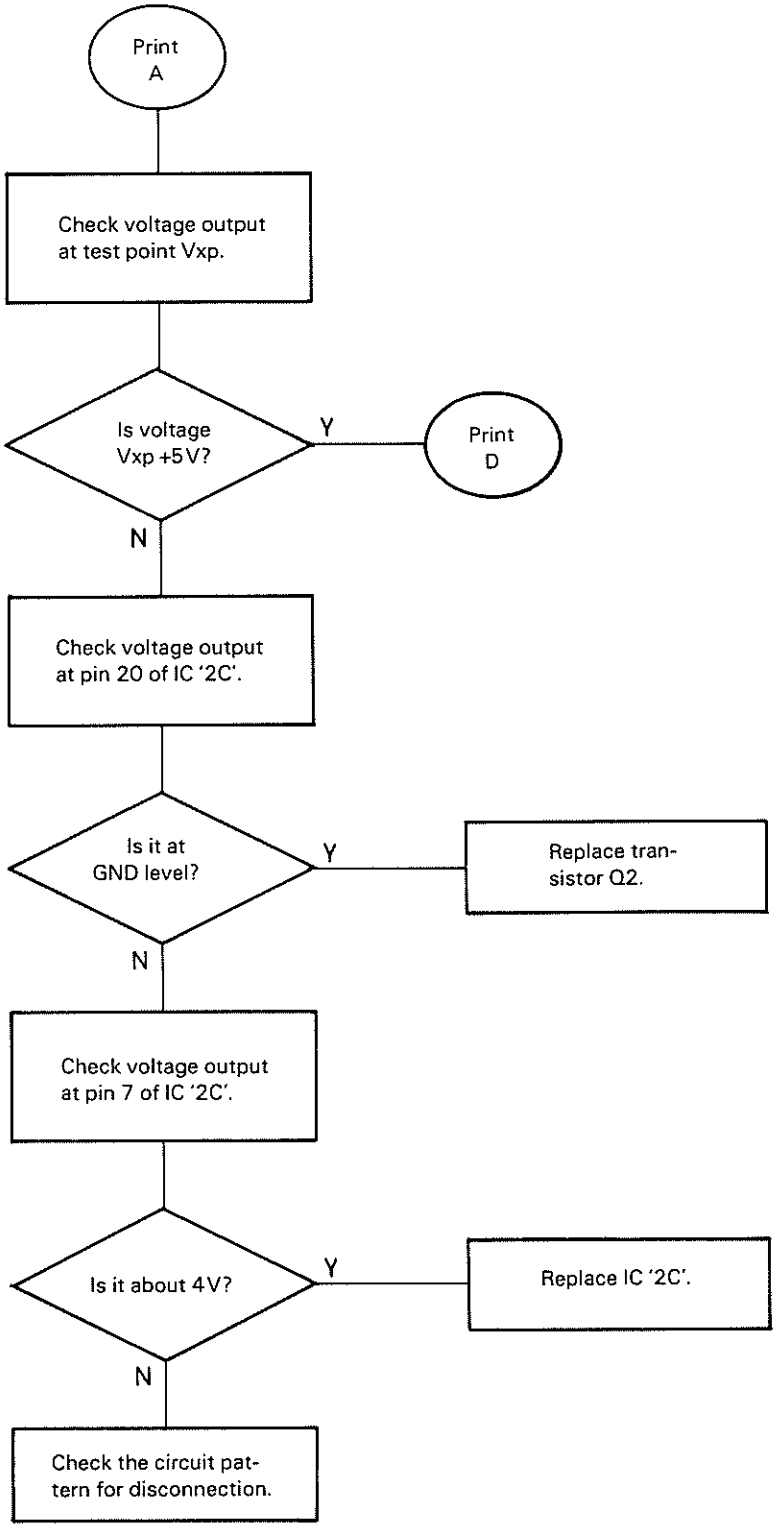
Tester leads		Resistance value (ohms)
Positive lead (+)	Negative lead (–)	
Emitter	Base	1.9 K
Emitter	Collector	∞
Base	Emitter	2 K
Base	Collector	∞
Collector	Emitter	1.6 K
Collector	Base	1.7 K

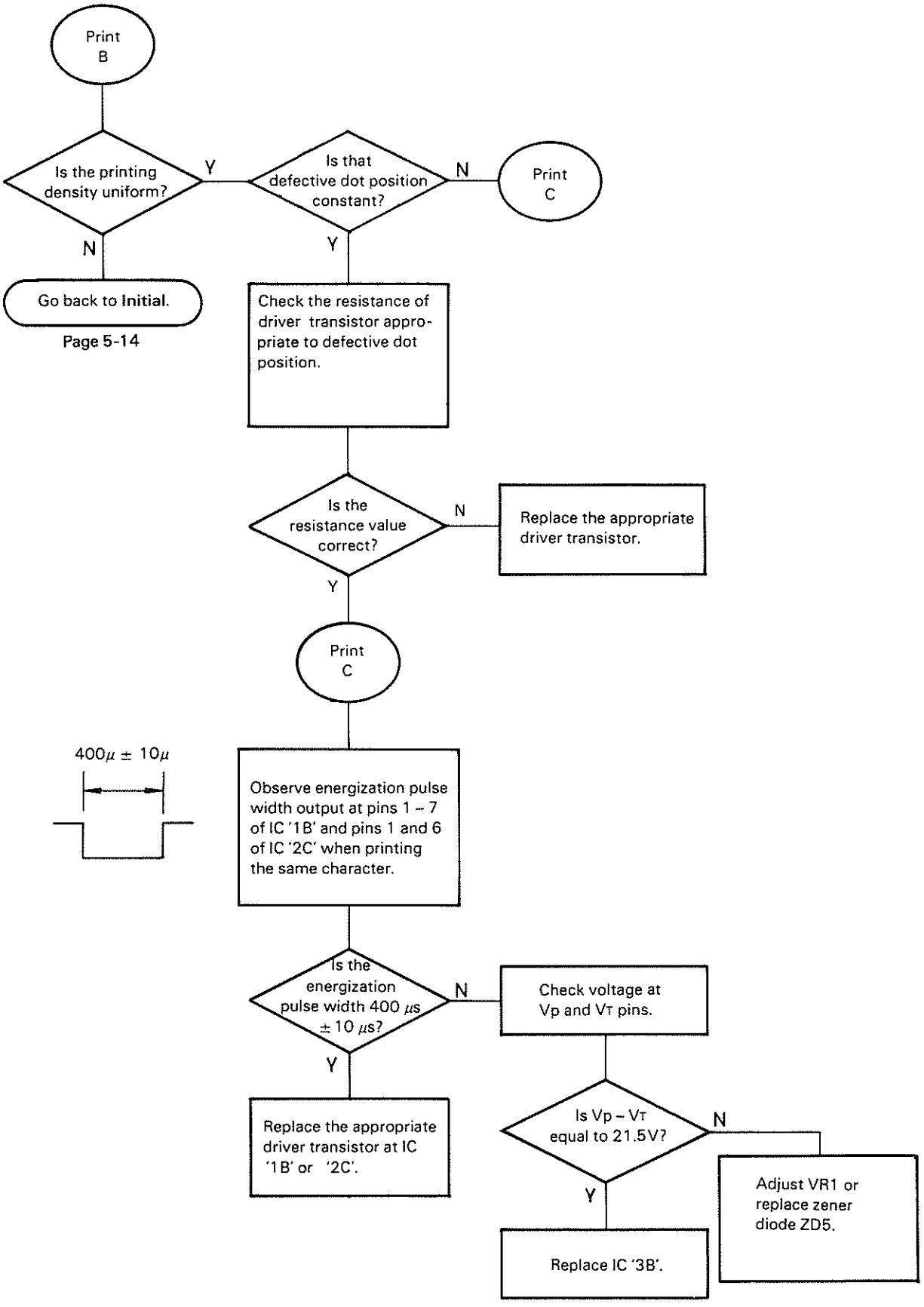


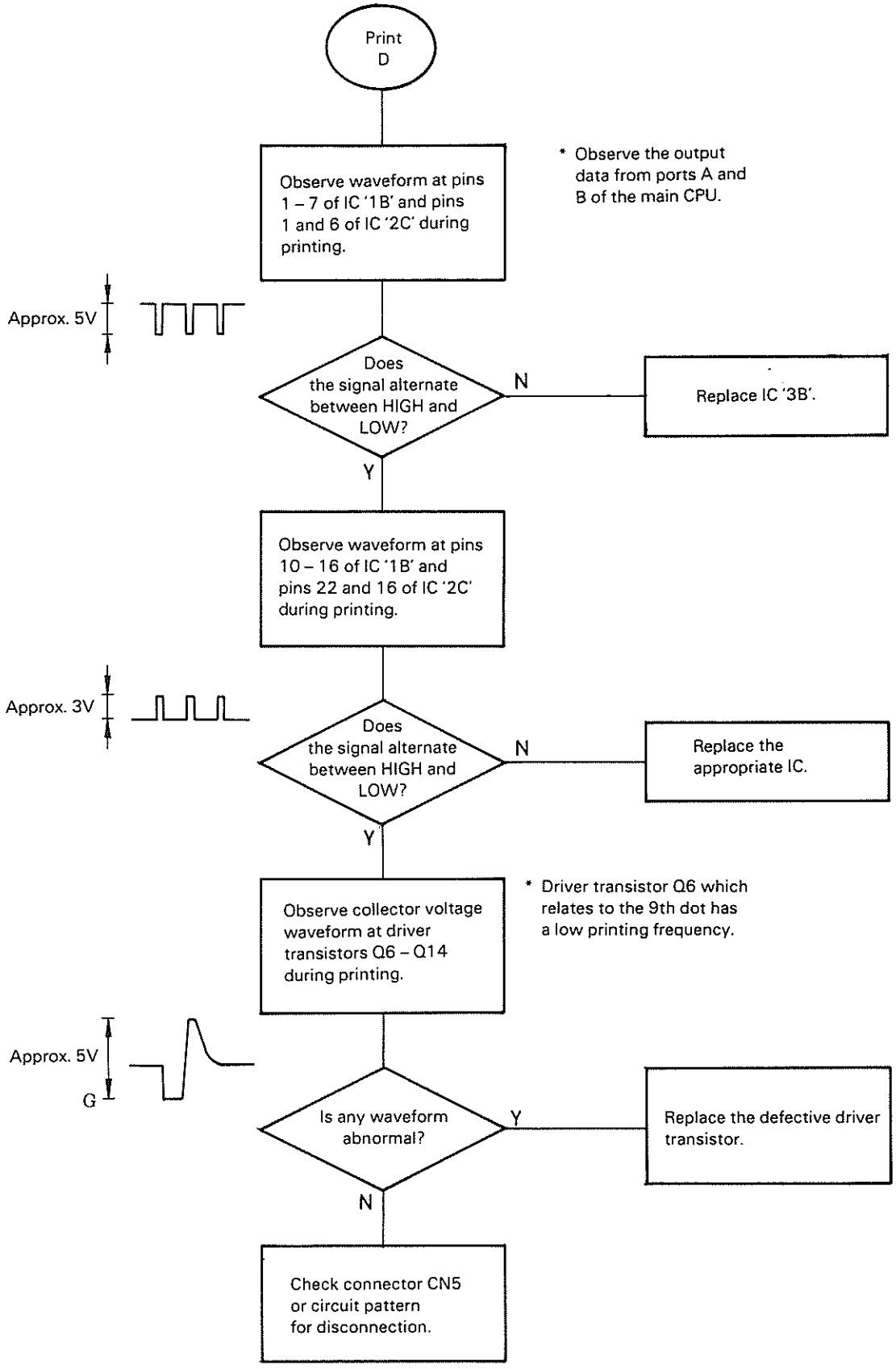

Alarm
E
Are all pins
at GND level?
N
Check voltage output
at pins 2 and 6
of IC '2C'.
Y
Check voltage output
at pin 36 of IC
'3B' (AN2).
Are all pins
at about 5 V?
N
Replace IC '3B'.
Y
Replace IC 2C.
Is the pin at
about 4 V?
Y
Replace IC 2C.
N
Measure the resistances
of diodes D6, D7, D8, D12
and DM1.
Is any diode
abnormal?
Y
Replace the defec-
tive diode.
N
Replace IC 3B.

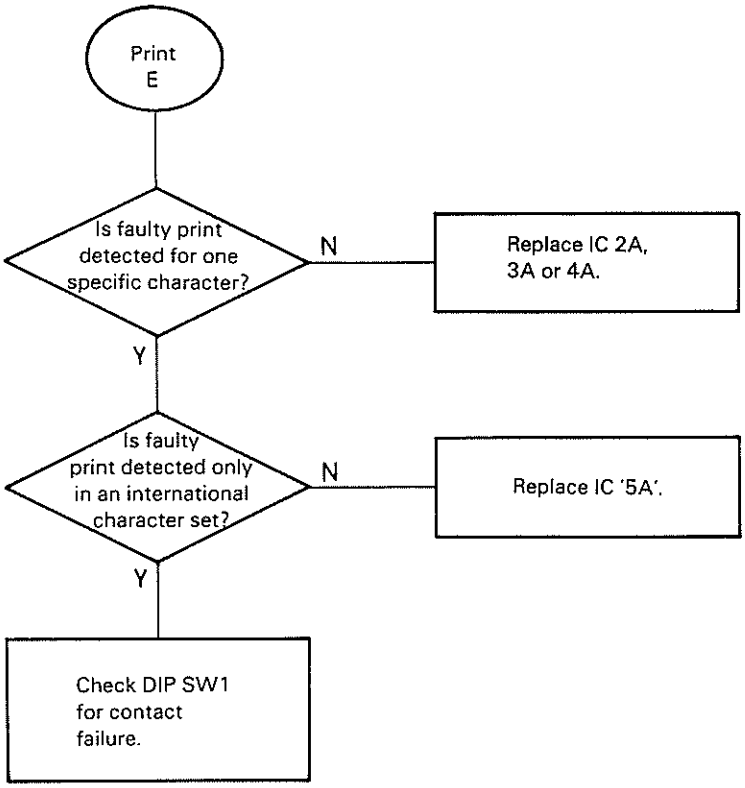

Alarm
F
Abnormally High Voltage Is Detected.
Observe voltage output at power ON from test point Vp.
Is the voltage more than +24V?
Y
N
Check the input voltage between pins 1 and 2 of connector CN6.
Check voltage output at power ON from pin 36 of IC '3C'.
Is the voltage about 30 V AC?
N
Y
Check the input voltage.
Replace IC1.
Is the voltage more than +4V?
Y
N
Check zener diode ZD5 and diode D11.
Replace IC '3B'.

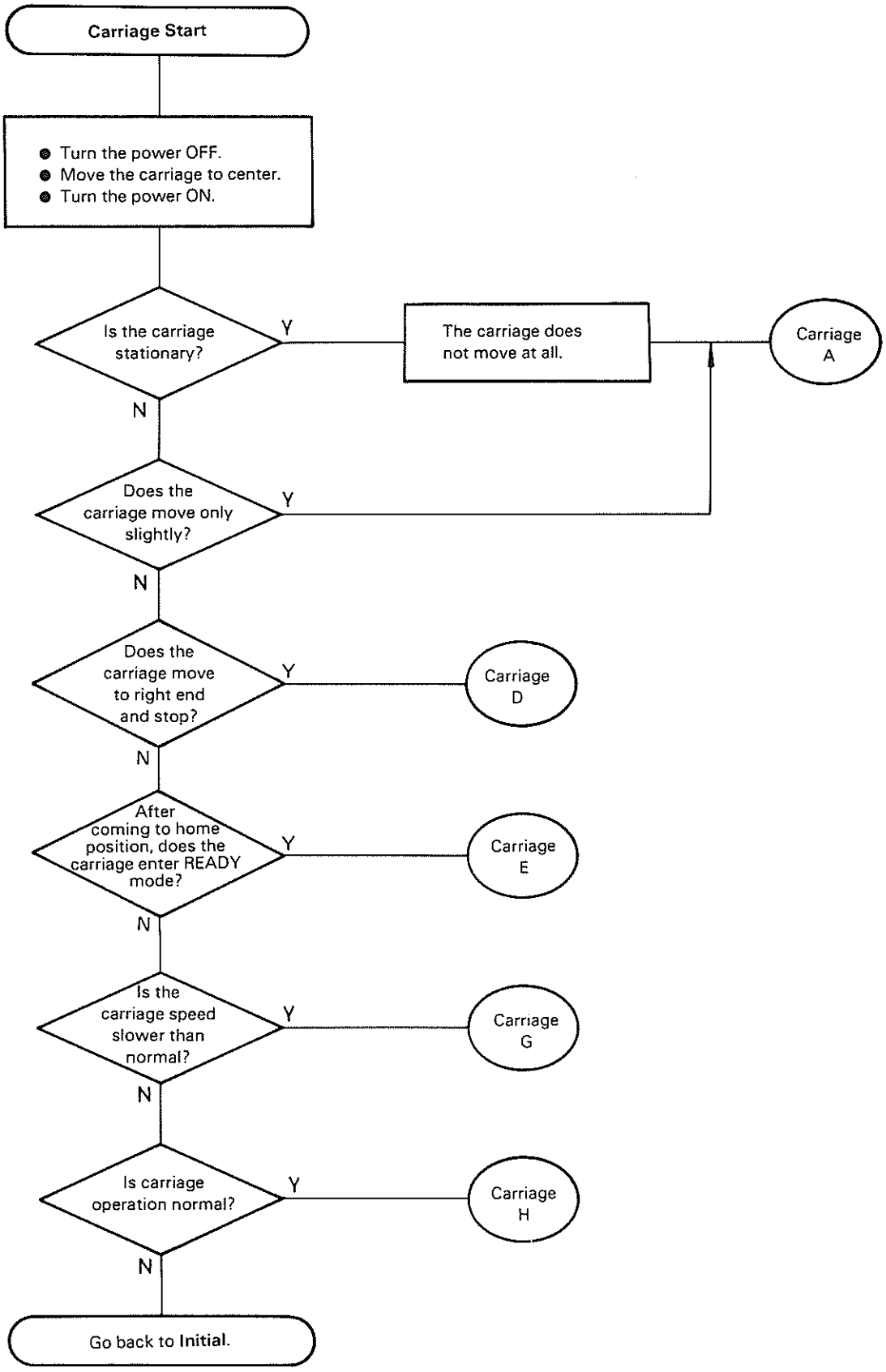

Print Start.
Set ribbon cartridge.
Set paper.
Perform both draft and NLQ self-print test.
Refer to Page 5-15.
Is carriage operation normal?
N
Go to "Carriage Start".
Y
Is printing executed?
N
Is paper feed operation normal?
N
Go to "Paper Start".
Y
Y
Print A
Does any dot missing?
Y
Print D
N
Is faulty printing executed?
Y
Print E
N
Print B


Print
A
Check voltage output
at test point Vxp.
Is voltage
Vxp +5V?
Y
Print
D
N
Check voltage output
at pin 20 of IC '2C'.
Is it at
GND level?
Y
Replace tran-
sistor Q2.
N
Check voltage output
at pin 7 of IC '2C'.
Is it about 4V?
Y
Replace IC '2C'.
N
Check the circuit pat-
tern for disconnection.

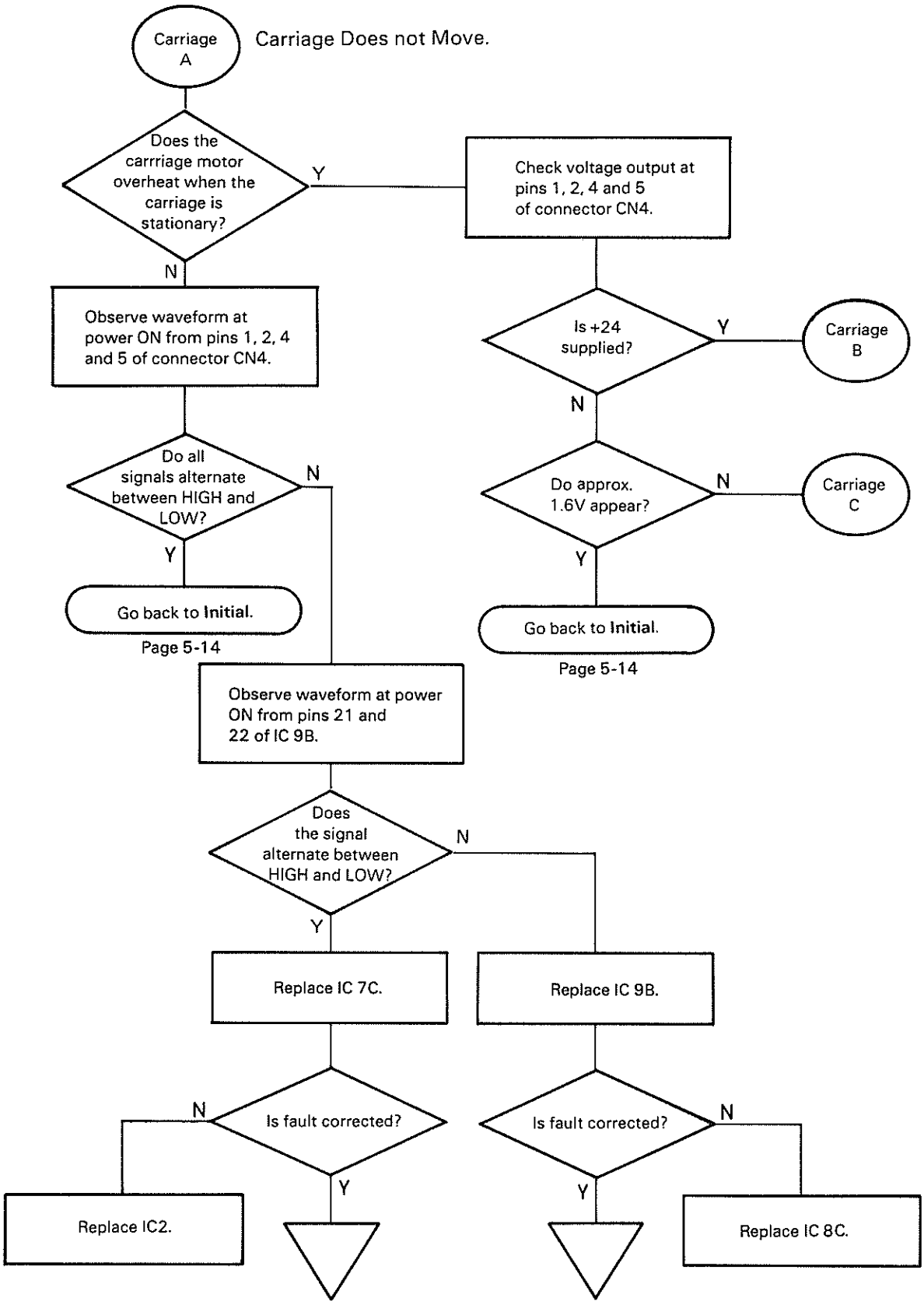

Print B
Is the printing density uniform?
Y
N
Is that defective dot position constant?
N
Y
Print C
Go back to Initial.
Page 5-14
Check the resistance of driver transistor appropriate to defective dot position.
Is the resistance value correct?
N
Y
Replace the appropriate driver transistor.
Print C
400μ ± 10μ
Observe energization pulse width output at pins 1 – 7 of IC '1B' and pins 1 and 6 of IC '2C' when printing the same character.
Is the energization pulse width 400 μs ± 10 μs?
N
Y
Check voltage at Vp and VT pins.
Is Vp – VT equal to 21.5V?
N
Y
Adjust VR1 or replace zener diode ZD5.
Replace IC '3B'.
Replace the appropriate driver transistor at IC '1B' or '2C'.

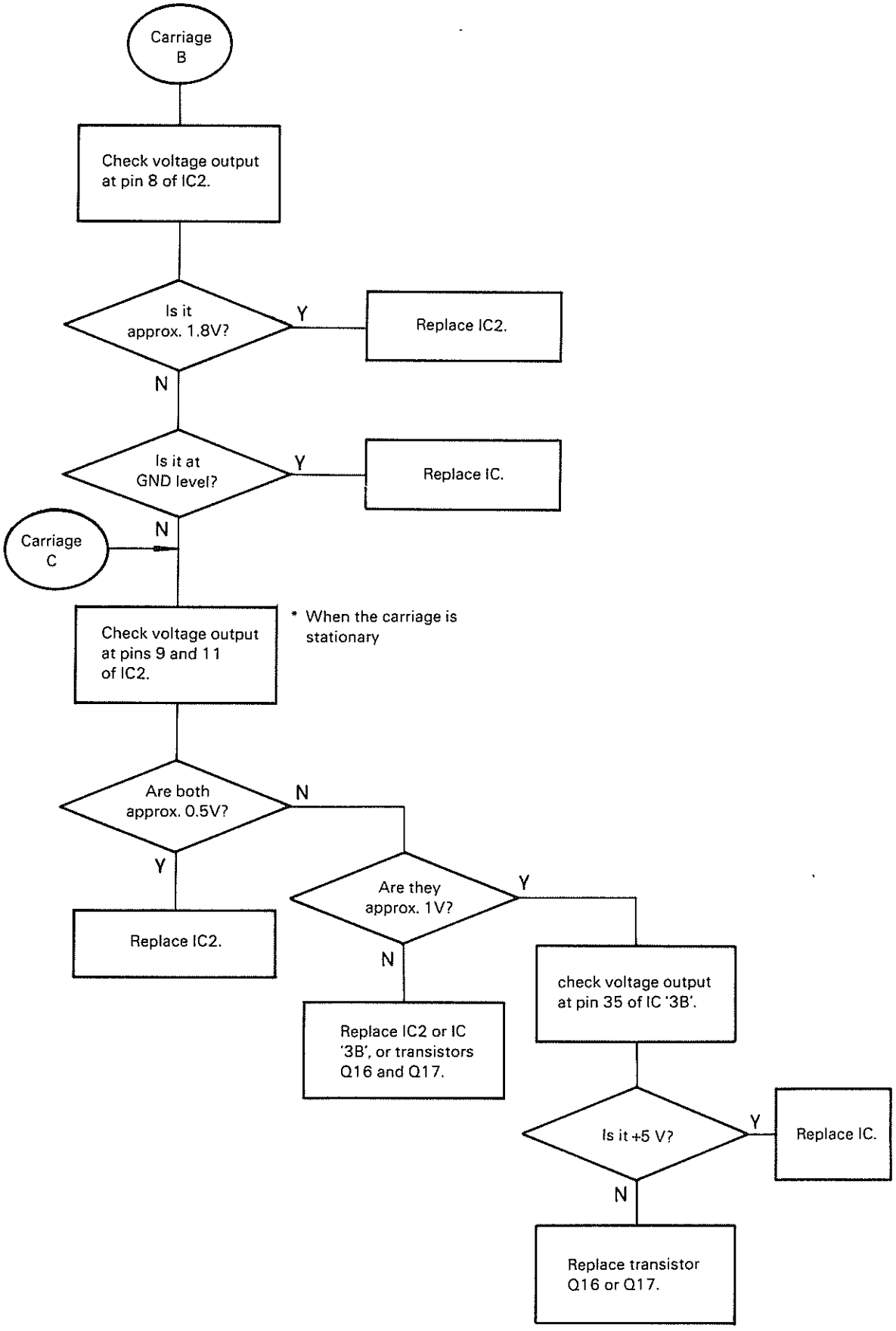

Print D
Observe waveform at pins 1 – 7 of IC '1B' and pins 1 and 6 of IC '2C' during printing.
* Observe the output data from ports A and B of the main CPU.
Approx. 5V
Does the signal alternate between HIGH and LOW?
N
Replace IC '3B'.
Y
Observe waveform at pins 10 – 16 of IC '1B' and pins 22 and 16 of IC '2C' during printing.
Approx. 3V
Does the signal alternate between HIGH and LOW?
N
Replace the appropriate IC.
Y
Observe collector voltage waveform at driver transistors Q6 – Q14 during printing.
* Driver transistor Q6 which relates to the 9th dot has a low printing frequency.
Approx. 5V
G
Is any waveform abnormal?
Y
Replace the defective driver transistor.
N
Check connector CN5 or circuit pattern for disconnection.


Print
E
Is faulty print detected for one specific character?
N
Replace IC 2A, 3A or 4A.
Y
Is faulty print detected only in an international character set?
N
Replace IC '5A'.
Y
Check DIP SW1 for contact failure.

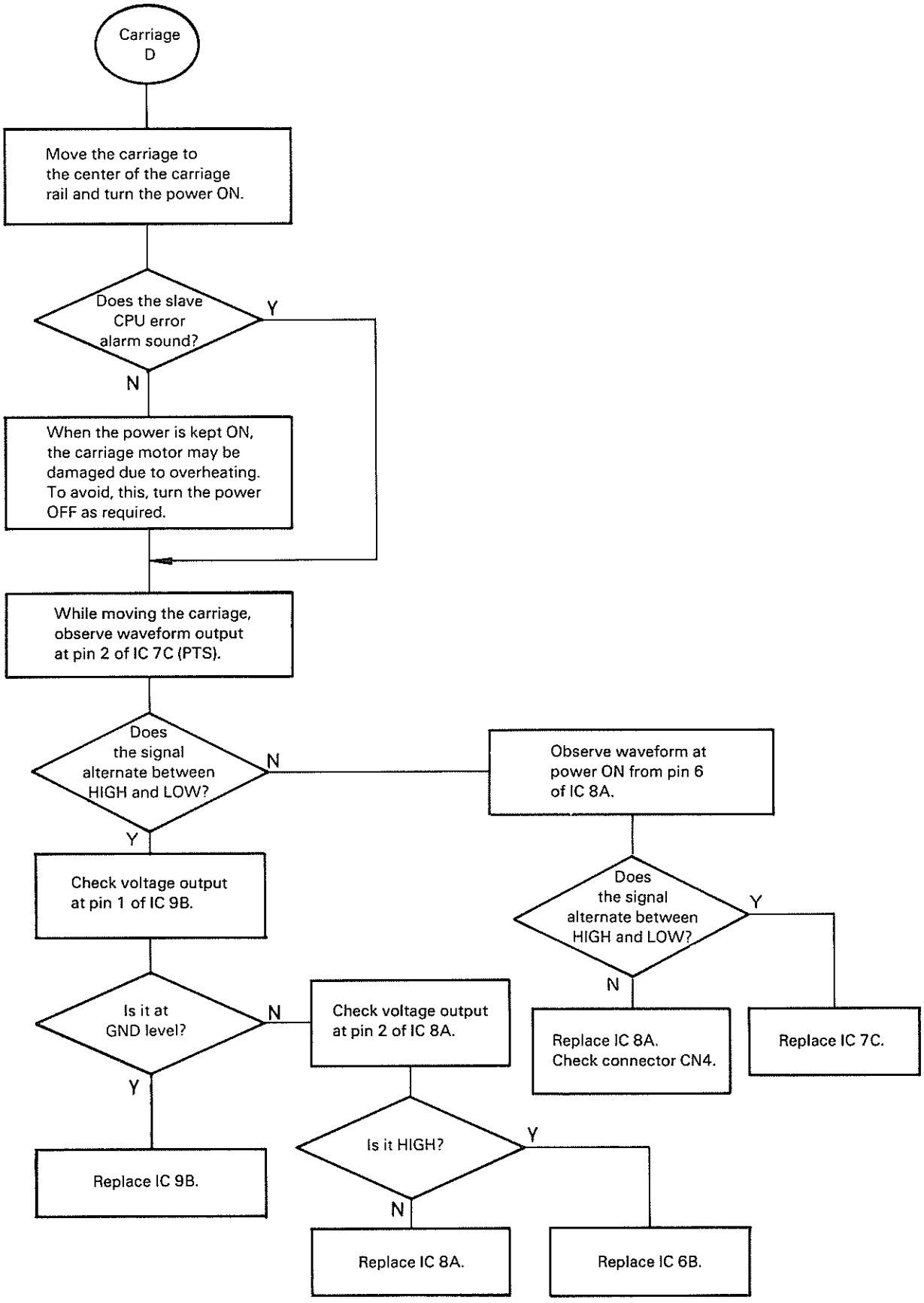

Carriage Start
Turn the power OFF.
Move the carriage to center.
Turn the power ON.
Is the carriage stationary?
Y
The carriage does not move at all.
Carriage A
N
Does the carriage move only slightly?
Y
N
Does the carriage move to right end and stop?
Y
Carriage D
N
After coming to home position, does the carriage enter READY mode?
Y
Carriage E
N
Is the carriage speed slower than normal?
Y
Carriage G
N
Is carriage operation normal?
Y
Carriage H
N
Go back to Initial.

Page 5-14

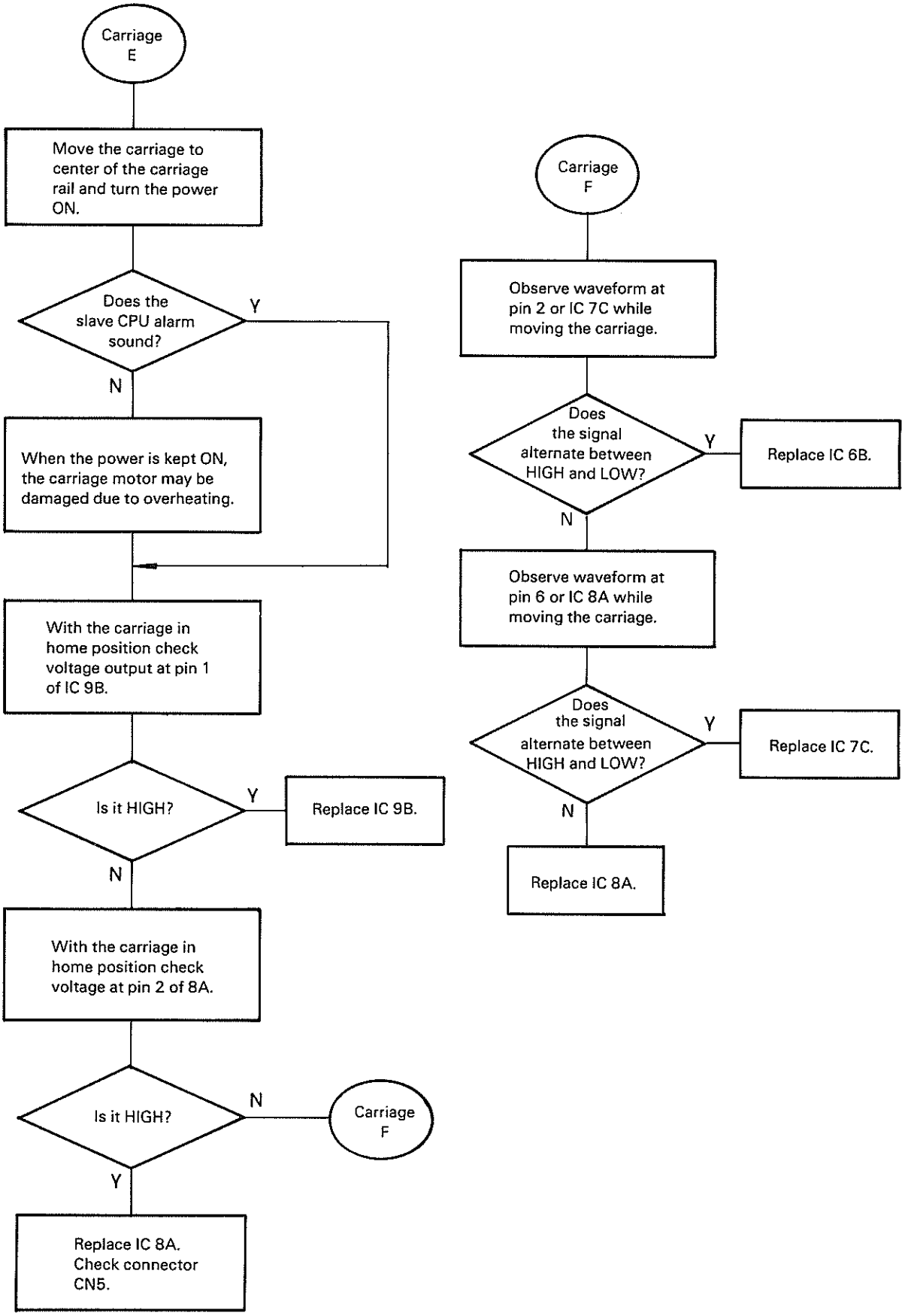

Carriage A
Carriage Does not Move.
Does the carrriage motor overheat when the carriage is stationary?
Y
N
Check voltage output at pins 1, 2, 4 and 5 of connector CN4.
Observe waveform at power ON from pins 1, 2, 4 and 5 of connector CN4.
Is +24 supplied?
Y
Carriage B
N
Do all signals alternate between HIGH and LOW?
N
Y
Go back to Initial.
Page 5-14
Do approx. 1.6V appear?
N
Carriage C
Y
Go back to Initial.
Page 5-14
Observe waveform at power ON from pins 21 and 22 of IC 9B.
Does the signal alternate between HIGH and LOW?
N
Y
Replace IC 7C.
Replace IC 9B.
N
Is fault corrected?
Y
Is fault corrected?
N
Y
Replace IC2.
Replace IC 8C.


Carriage B
Check voltage output at pin 8 of IC2.
Is it approx. 1.8V?
Y
Replace IC2.
N
Is it at GND level?
Y
Replace IC.
N
Carriage C
Check voltage output at pins 9 and 11 of IC2.
* When the carriage is stationary
Are both approx. 0.5V?
N
Y
Replace IC2.
Are they approx. 1V?
Y
N
Replace IC2 or IC '3B', or transistors Q16 and Q17.
check voltage output at pin 35 of IC '3B'.
Is it +5 V?
Y
Replace IC.
N
Replace transistor Q16 or Q17.

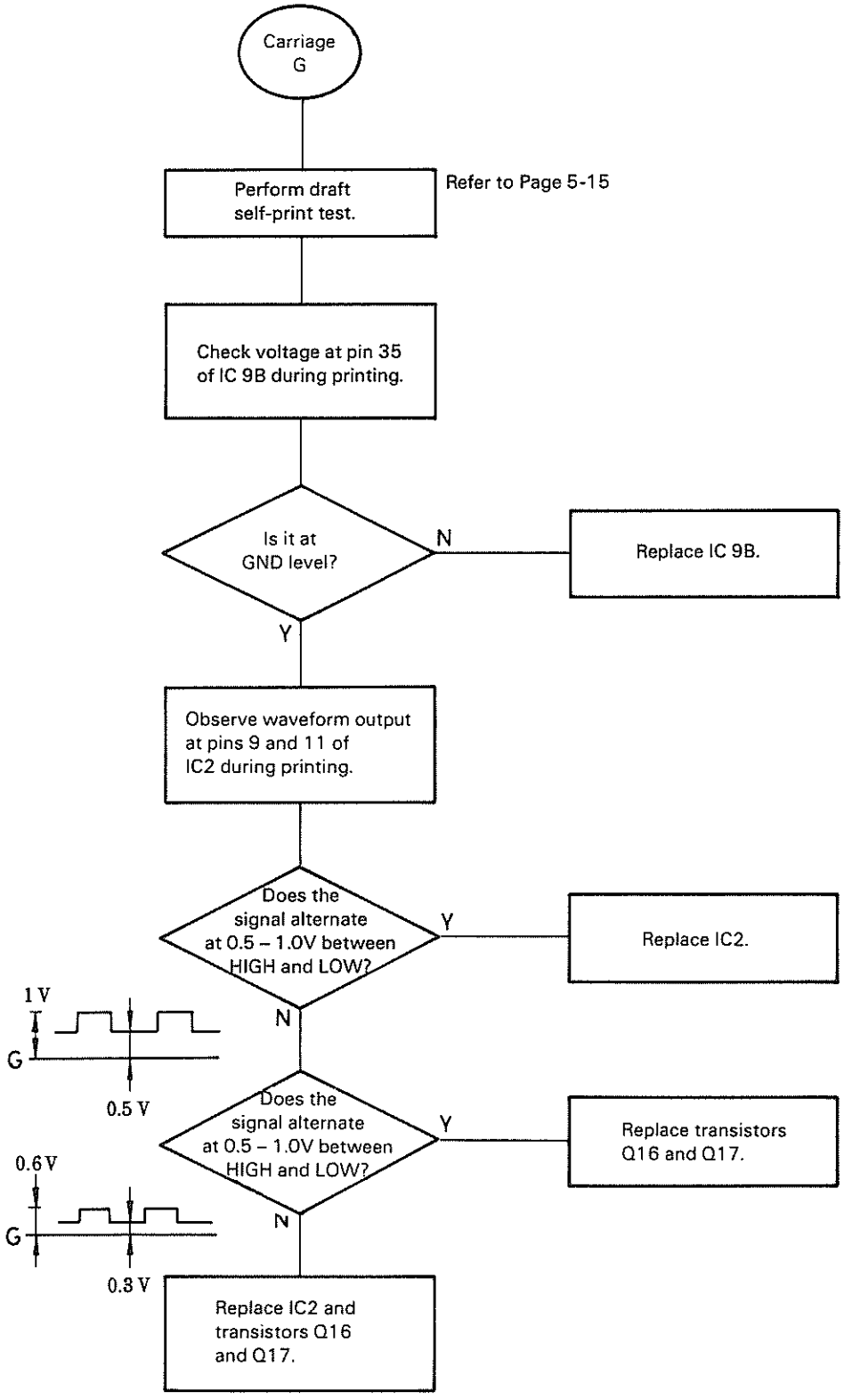
Carriage Moves to Right End and Strikes Right Margin Stop.

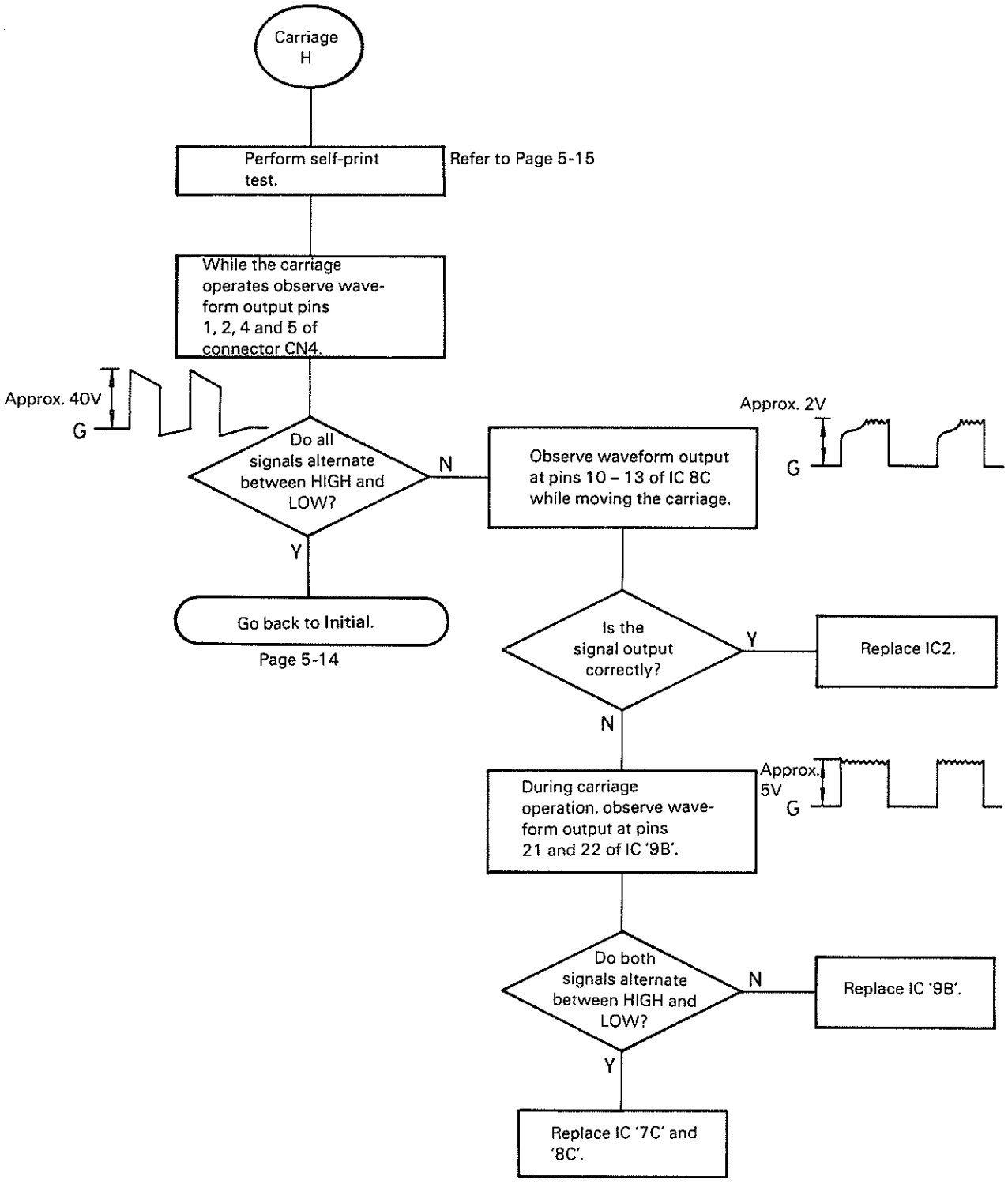


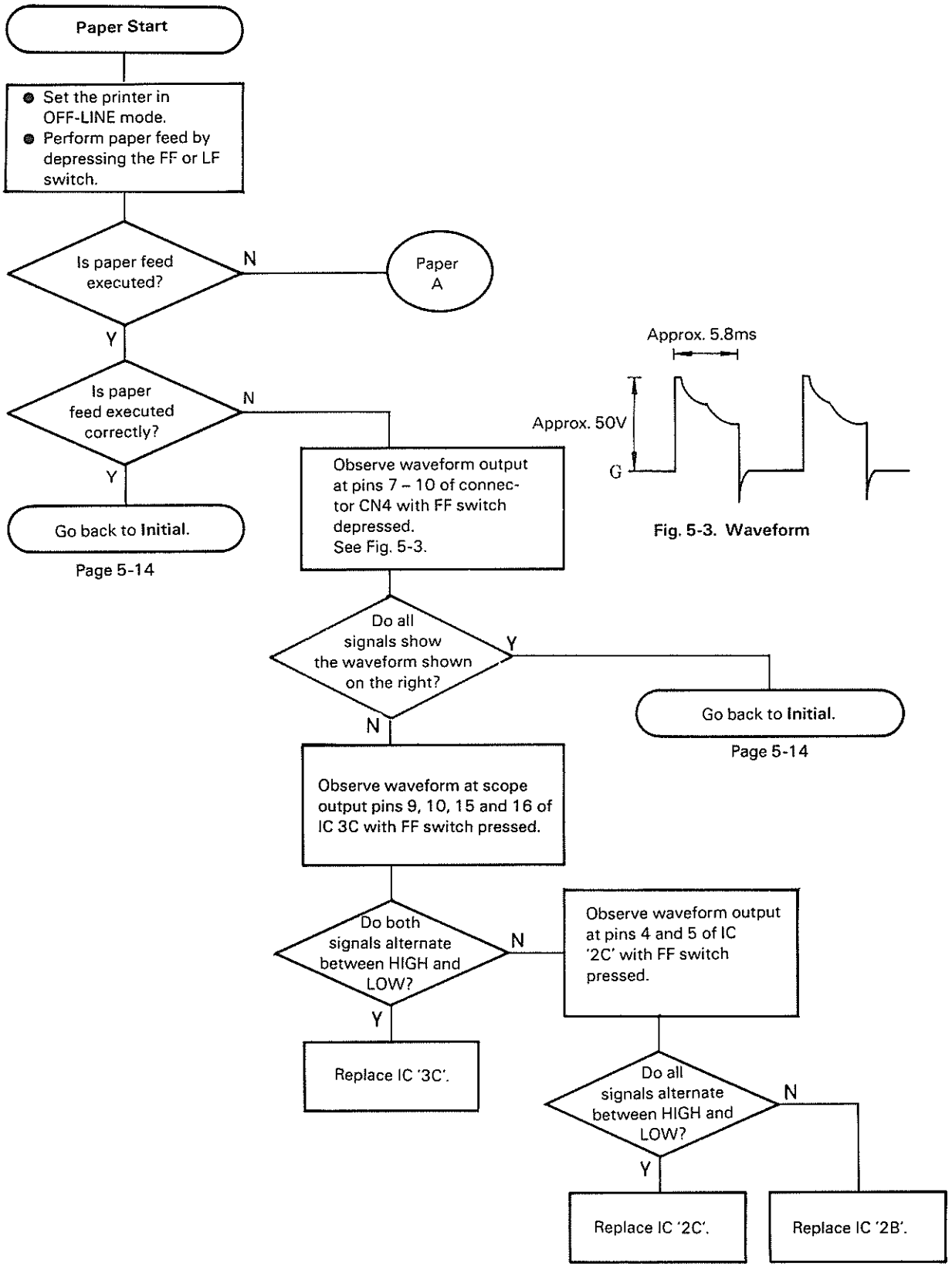
Although Carriage Moves to the Left (Home Position), Printer Does not Enter READY Mode.



Carriage Speed is Slower than Normal




Carriage H
Perform self-print test.
Refer to Page 5-15
While the carriage operates observe waveform output pins 1, 2, 4 and 5 of connector CN4.
Approx. 40V
G
Do all signals alternate between HIGH and LOW?
N
Y
Go back to Initial.
Page 5-14
Observe waveform output at pins 10 – 13 of IC 8C while moving the carriage.
Approx. 2V
G
Is the signal output correctly?
Y
Replace IC2.
N
During carriage operation, observe waveform output at pins 21 and 22 of IC '9B'.
Approx. 5V
G
Do both signals alternate between HIGH and LOW?
N
Replace IC '9B'.
Y
Replace IC '7C' and '8C'.


Paper Start
● Set the printer in OFF-LINE mode.
● Perform paper feed by depressing the FF or LF switch.
Is paper feed executed?
N
Paper A
Y
Is paper feed executed correctly?
N
Y
Go back to Initial.
Page 5-14
Observe waveform output at pins 7 – 10 of connector CN4 with FF switch depressed.
See Fig. 5-3.
Approx. 5.8ms
Approx. 50V
G
Fig. 5-3. Waveform
Do all signals show the waveform shown on the right?
Y
Go back to Initial.
Page 5-14
N
Observe waveform at scope output pins 9, 10, 15 and 16 of IC 3C with FF switch pressed.
Do both signals alternate between HIGH and LOW?
N
Observe waveform output at pins 4 and 5 of IC '2C' with FF switch pressed.
Y
Replace IC '3C'.
Do all signals alternate between HIGH and LOW?
N
Y
Replace IC '2C'.
Replace IC '2B'.

Paper A

Paper Is Not Fed At All.

* Set the printer in OFF-LINE mode.
* Activate paper feed by depressing the FF or LF switch.

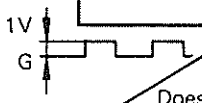
Check voltage output at pins 14 and 15 of IC '3B'.

Is it at GND level while the switch is depressed?

N → Check the control panel and connector CN7.

Y

Observe waveform output at pin 19 of IC '3B' with FF switch depressed.

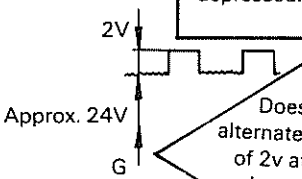


Does the signal alternate at 1V to GND level between HIGH and LOW?

N → Replace IC '3B'.

Y

Observe waveform output at base of transistor Q15 with FF switch depressed.



Does the signal alternate within a range of 2v at around 24V between HIGH and LOW?

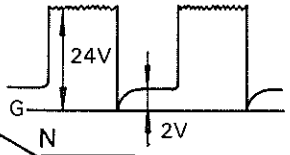
N → Replace transistor Q5.

Y

Observe waveform output at pins 11 and 12 of connector CN4 with FF switch depressed.

Paper B

Paper B



Does the signal alternate from +24V to +2V between HIGH and LOW.

N → Replace transistor Q15. Check diode D2.

Is fault corrected?

N → (to Observe waveform output at pins 23 and 24 of IC '3B' with FF switch depressed.)

Y

Observe waveform output at pins 23 and 24 of IC '3B' with FF switch depressed.

Do both signals alternate between HIGH and LOW?

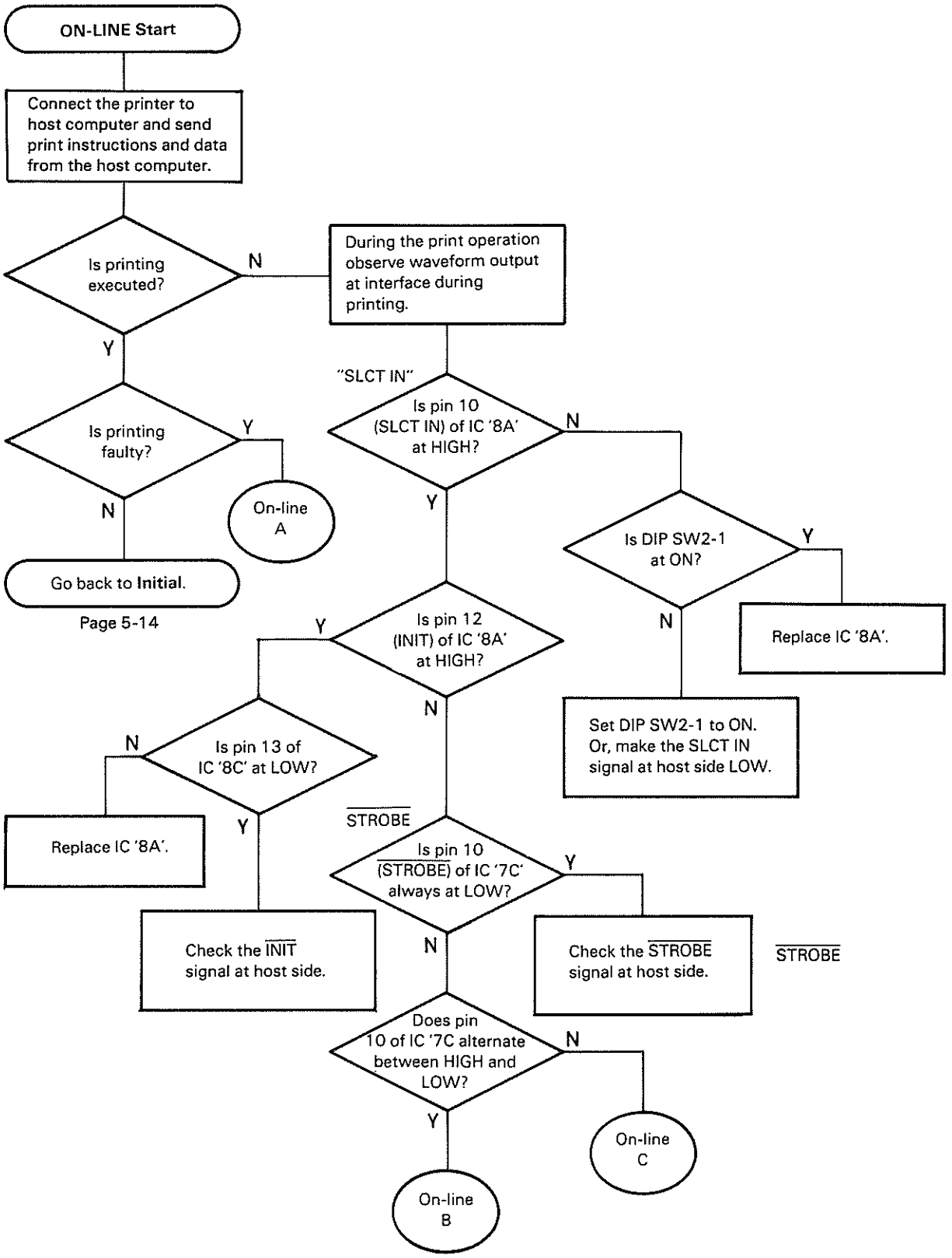
Y → Replace IC '3B'.

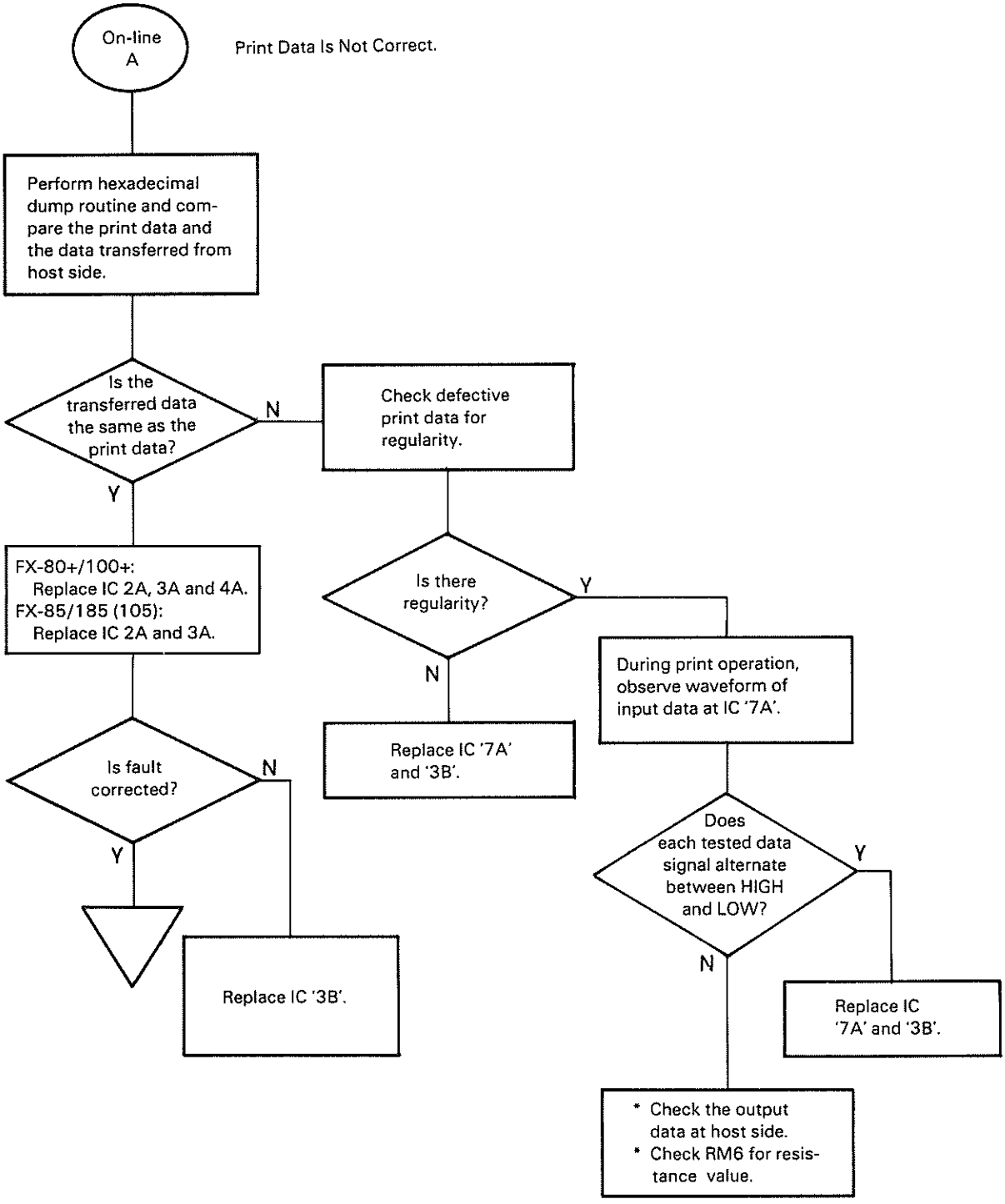
Observe waveform output at pins 13 and 14 of IC '2C' with FF switch depressed.

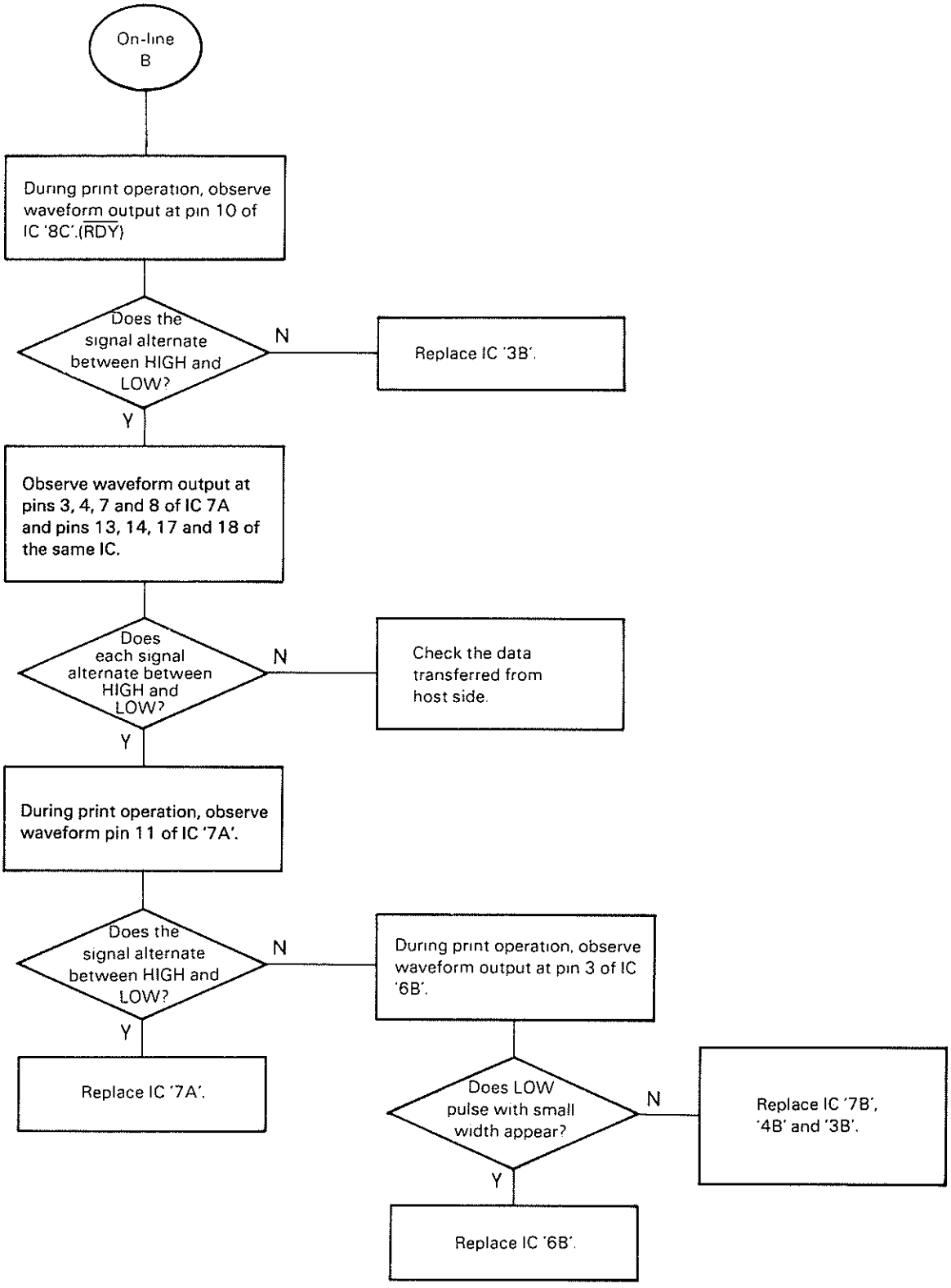
Do both signals alternate between HIGH and LOW?

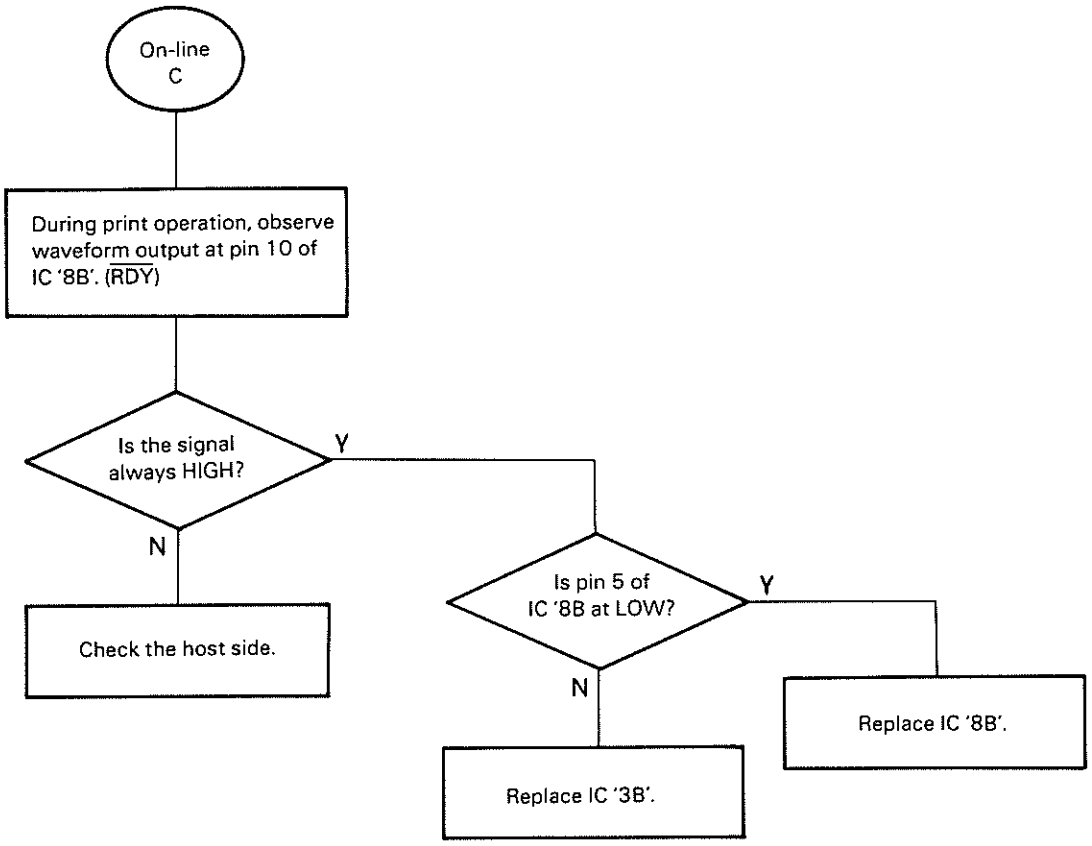
Y → Replace IC '3C'.

N → Replace IC '2C'.

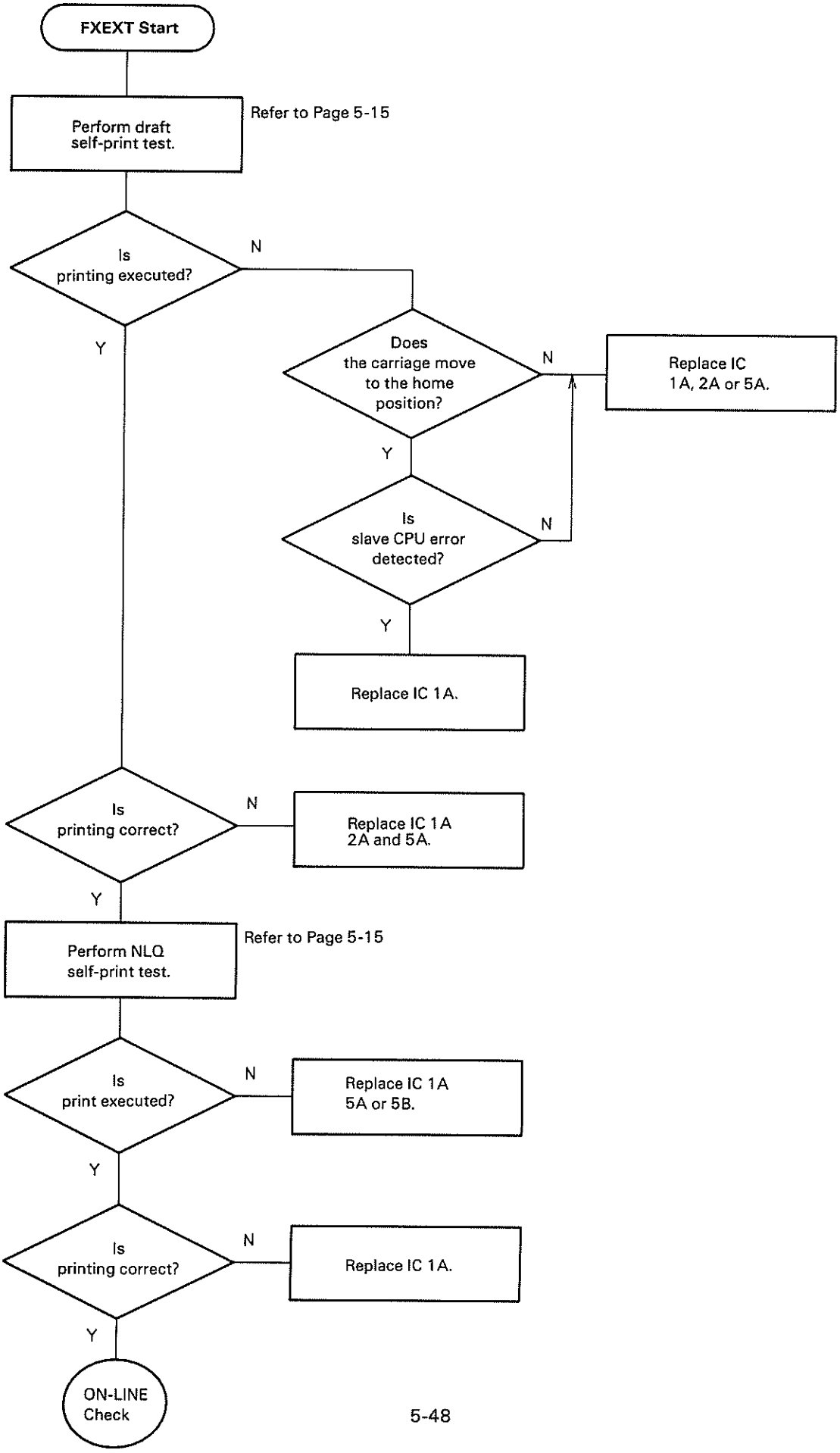

ON-LINE Start
Connect the printer to host computer and send print instructions and data from the host computer.
Is printing executed?
N
During the print operation observe waveform output at interface during printing.
Y
"SLCT IN"
Is printing faulty?
Y
Is pin 10 (SLCT IN) of IC '8A' at HIGH?
N
On-line A
N
Y
Is DIP SW2-1 at ON?
Y
Go back to Initial.
Page 5-14
Y
Is pin 12 (INIT) of IC '8A' at HIGH?
N
Replace IC '8A'.
Set DIP SW2-1 to ON. Or, make the SLCT IN signal at host side LOW.
N
Is pin 13 of IC '8C' at LOW?
STROBE
Replace IC '8A'.
Y
Is pin 10 (STROBE) of IC '7C' always at LOW?
Y
Check the INIT signal at host side.
N
Check the STROBE signal at host side.
STROBE
Does pin 10 of IC '7C alternate between HIGH and LOW?
N
Y
On-line C
On-line B

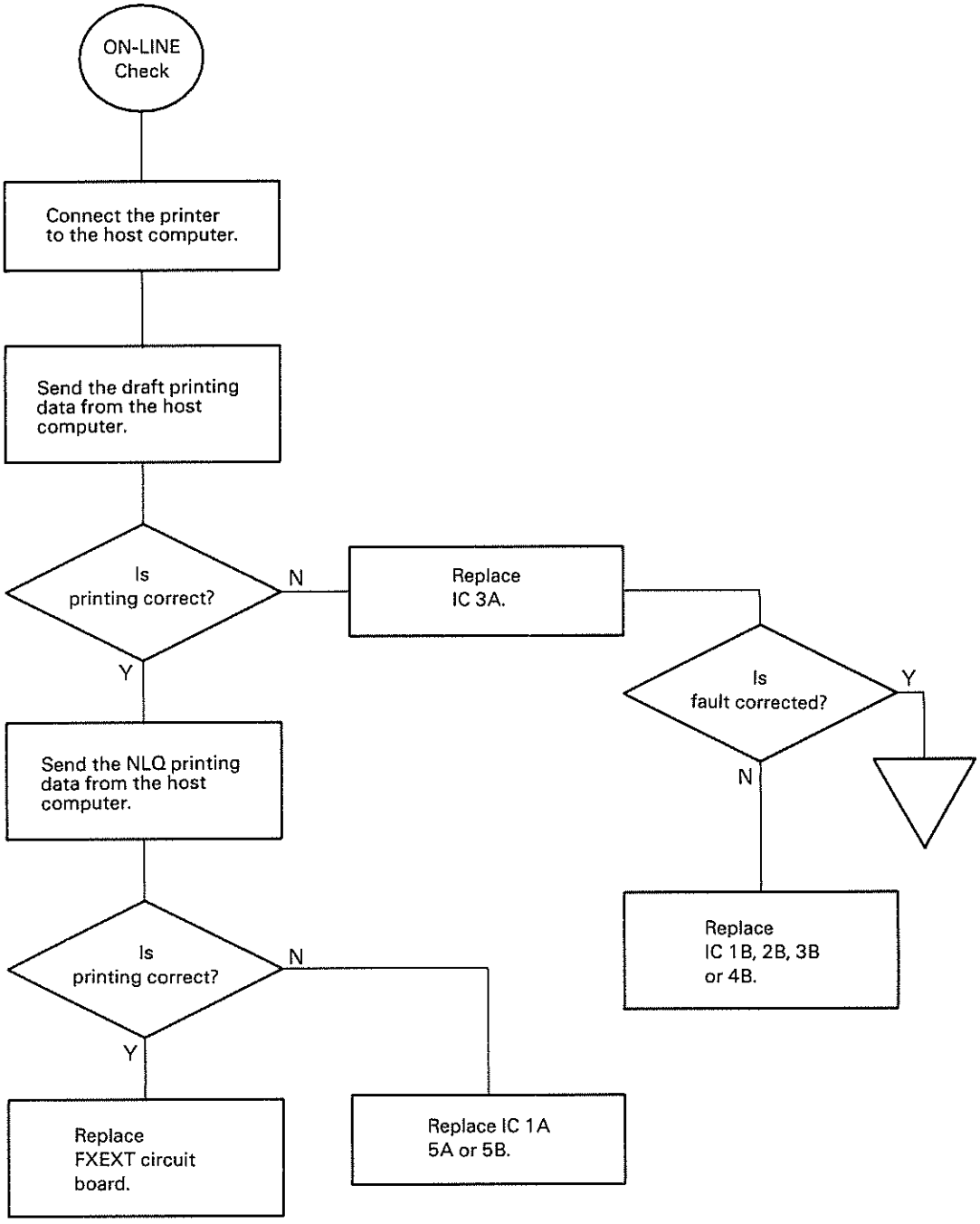

On-line
A
Print Data Is Not Correct.
Perform hexadecimal dump routine and compare the print data and the data transferred from host side.
Is the transferred data the same as the print data?
N
Y
Check defective print data for regularity.
Is there regularity?
Y
N
Replace IC '7A' and '3B'.
During print operation, observe waveform of input data at IC '7A'.
Does each tested data signal alternate between HIGH and LOW?
Y
N
Replace IC '7A' and '3B'.
* Check the output data at host side.
* Check RM6 for resistance value.
FX-80+/100+:
Replace IC 2A, 3A and 4A.
FX-85/185 (105):
Replace IC 2A and 3A.
Is fault corrected?
N
Y
Replace IC '3B'.


On-line
B
During print operation, observe waveform output at pin 10 of IC '8C'.(RDY)
Does the signal alternate between HIGH and LOW?
N
Replace IC '3B'.
Y
Observe waveform output at pins 3, 4, 7 and 8 of IC 7A and pins 13, 14, 17 and 18 of the same IC.
Does each signal alternate between HIGH and LOW?
N
Check the data transferred from host side.
Y
During print operation, observe waveform pin 11 of IC '7A'.
Does the signal alternate between HIGH and LOW?
N
During print operation, observe waveform output at pin 3 of IC '6B'.
Y
Replace IC '7A'.
Does LOW pulse with small width appear?
N
Replace IC '7B', '4B' and '3B'.
Y
Replace IC '6B'.


On-line
C
During print operation, observe waveform output at pin 10 of IC '8B'. (RDY)
Is the signal always HIGH?
Y
N
Check the host side.
Is pin 5 of IC '8B at LOW?
Y
N
Replace IC '8B'.
Replace IC '3B'.

5.4.2 TROUBLESHOOTING FOR FXEXT CIRCUIT BOARD (FX-85/185/105 ONLY)




ON-LINE Check
Connect the printer to the host computer.
Send the draft printing data from the host computer.
Is printing correct?
N
Replace IC 3A.
Y
Is fault corrected?
Y
N
Send the NLQ printing data from the host computer.
Replace IC 1B, 2B, 3B or 4B.
Is printing correct?
N
Y
Replace FXEXT circuit board.
Replace IC 1A 5A or 5B.

CHAPTER 6
MAINTENANCE

LIST OF FIGURES

LIST OF TABLES

6.1 MAINTENANCE

Proper maintenance is essential for the printer to keep its designed performance for the longest possible period, and to minimize malfunction frequency of malfunction. Carry out maintenance according to the following instructions.

6.1.1 CLEANING

(1) Using alcohol remove any dirt or stains.

NOTE: Never use thinner, trichloroethylene or ketone-based solvents, which might deteriorate plastic parts.

(2) Remove paper particles and dust.

To remove any paper particles and dust from the surface and inside of the printer, it is recommended that a vacuum cleaner be used.

NOTE: After cleaning, check the lubrication points for quantity of lubricant. Resupply the specified lubricant, as required. (Refer to 2.4 Lubrication Requirments.)

6.1.2 INSPECTION

Inspection of the printer may be divided into the following categories:

(1) Daily inspection:

This can easily be carried out by the printer operator. As part of his routine work, the operator should check the printer for proper use and maintenance.

- Check points:
- Check if the paper is not caught around or by the paper feed box, the printer casing or other objects.
- Check if the cassette ribbon for proper position.
- Check if dusts or other foreign materials which might impede printer operation.

(2) Periodic inspection:

The following checks should be carried out only by persons who are familiar with the operating principles and mechanisms of printers. The printer should be inspected and lubricated by such persons every six months or after 1,000,000 lines of print.

- Check points:
- Clean carriage shafts A and B,ts A and B, and apply lubricant O-2.
- Clean the gears of the carriage, and apply lubricant G-14.
- Check the springs and ribbon driving wire for deformation or damage.
- Check if the cassette ribbon is properly set in position.
- Check the dot head/platen distance.
- Remove paper particles, dust, and other foreign materials from around the HP sensor and surrounding components.

6.2 LUBRICATION

Proper lubrication is essential for the printer to keep its designed performance for the longest possible period, and to minimize possibility of problems. Carry out lubrication according to the following instructions:

6.2.1 LUBRICANTS

The properties of lubricants used have a great influence on the performance and durability of the printer. In particular, attention must be paid to the low temperature characteristics. It is strongly recommended to use only those lubricants that we have selected after extensive study of technical information and a series of tests on many types of lubricants.

We can supply such lubricants in a metallic can or a plastic container of 40 cc (40 gr), which is the minimum supply unit available.

6.2.2 LUBRICATION REQUIREMENTS

The lubricants to be used for the printer are G-14 and O-2. Whenever disassembling and reassembling the printer, supply the specified quantity of appropriate lubricant to the lubrication points according to the list below or the lubrication and adhesive application points drawings. (The numbers given in the list correspond to those given in the drawing.) Be sure to thoroughly clean the elements or parts concerned prior to application of lubricant.

The required frequency of periodic lubrication is as follows. When the lubricant is removed by cleaning or when the printer is disassembled or its parts are replaced, be sure to lubricate irrespective of the time set for periodic lubrication.

A) Every six months or after every 1,000,000 lines of print.

B) Every occasion of overhaul or after every 5,000,000 lines have print.

6.2.3 LUBRICATION POINTS

Table 6-1. Model-3510 Lubrication points (See Figs. 6-2, 6-3 and 6-4)

Ref. No	Lubrication and adhesive application points drawing	Lubrication point	Lubricant	Required frequency
(1)	L-2	Carriage shaft A	O-2	A
(2)	L-2	Movable part of head lock lever	G-2	B
(3)	L-2	Hook part of head lock lever spring	G-2	B
(4)	L-2	Sliding part of head adjusting lever	G-14	B
(5)	L-1	Gear of belt driving pulley sub ass'y	G-14	B
(6)	L-1	Shaft on which planetary pinion is placed	G-2	B
(7)	L-2	Teeth of platen gear	G-14	B
(8)	L-2	Teeth and shaft part of paper feeding reduction gear	G-14	B
(9)	L-3	Teeth of sprocket gear	G-14	B
(10)	L-1	Shaft on which ribbon driving gear is placed	G-14	B
(11)	L-1	Contacting parts of planetary gear and leaf spring	G-2	B
(12)	L-1	Shaft on which planetary lever sub ass'y is placed	G-2	B
(13)	L-1	Contacting parts of belt driven pulley flange and plain washer	G-2	B
(14)	L-2	Sliding part of paper holding lever R and L ass'y and frame	G-14	B
(15)	L-2	Sliding part between longer hole portion and E-shape portion of sub paper holding lever	G-14	B
(16)	L-2	Sliding part between release lever and sub release lever	G-14	B
(17)	L-2	Engagement part of paper holding lever and sub release lever	G-14	B
(18)	L-2	Paper feeding roller and paper feeding roller stand	G-14	B
(19)	L-2	Felt ring 168	O-2	A

Table 6-2. Model-3560 Lubrication points (See Figs. 6-5, 6-6 and 6-7)

Ref. No	Lubrication and adhesive application points drawing	Lubrication point	Lubricant	Required frequency
(1)	L-2	Carriage shaft A	O-2	A
(2)	L-2	Movable part of head lock lever	G-2	B
(3)	L-2	Hook part of head lock lever spring	G-2	B
(4)	L-2	Sliding part of head adjusting lever	G-14	B
(5)	L-1	Gear of belt driving pulley sub ass'y	G-14	B
(6)	L-1	Shaft on which planetary pinion is placed	G-2	B
(7)	L-2	Teeth of platen gear	G-14	B
(8)	L-2	Teeth and shaft part of paper feeding reduction gear	G-14	B
(9)	L-3	Teeth of sprocket gear	G-14	B
(10)	L-1	Shaft on which ribbon driving gear is placed	G-14	B
(11)	L-1	Contacting parts of planetary gear and leaf spring	G-2	B
(12)	L-1	Shaft on which planetary lever sub ass'y is placed	G-2	B
(13)	L-1	Contacting parts of belt driven pulley flange and plain washer	G-2	B
(14)	L-2	Sliding part between release lever and sub releaes lever	G-14	B
(15)	L-2	Paper feeding roller and paper feeding roller stand	G-14	B
(16)	L-2	Felt ring 168	O-2	A

6.2.4 ADHESIVE APPLICATION REQUIREMENTS

This printer contains some screws and nuts secured by adhesive to prevent loosening due to vibrations. During disassembly/reassembly or parts replacement, apply adhesive to the required points according to the list below or refer to the "Lubrication and Adhesive Application Points" drawing.
The adhesive to be used for the printer is Neji Lock Green # 2.

6.2.5 ADHESIVE APPLICATION POINTS

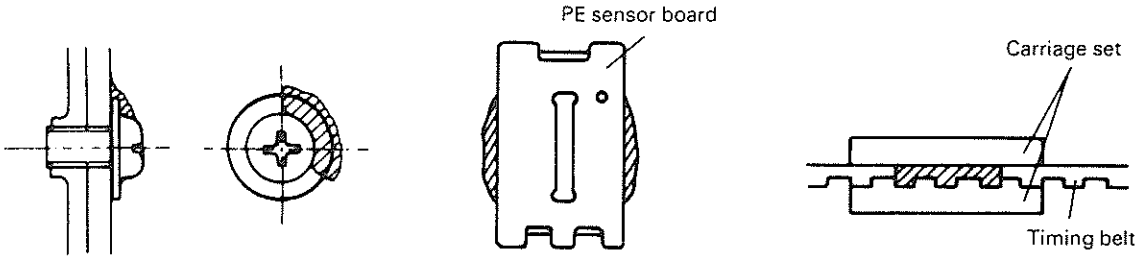
Table 6-3. Model-3510 Adhesive Application Points (See Figs. 6-2, 6-3 and 6-4)

Ref. No	Lubrication and adhesive application points drawing	Adhesive application point
(31)	L-1	Set-screw for terminal board ass'y (2 points)
(32)	L-1	Set-screw for belt tension plate sub ass'y (1 point)
(33)	L-1	Set-screw for PTS sensor ass'y (1 point)
(34)	L-1	Set-screw for HP sensor ass'y (1 point)
(35)	L-2	Set-screw for ribbon mask (2 points)
(36)	L-2	Inside of set-screw for scale (2 points)
(37)	L-2	Engagement part of carriage ass'y and timing belt (1 point)
(39)	L-1	Part between PTS sensor board and motor heat sinker (2 points)
(40)	L-2	Part between PE sensor board and lower paper guide (2 points)

Table 6-4. Model-3560 Adhesive Application Points (See Figs. 6-5, 6-6 and 6-7)

Ref. No	Lubrication and adhesive application points drawing	Adhesive application point
(31)	L-1	Set-screw for terminal board ass'y (2 points)
(32)	L-1	Set-screw for belt tension plate sub ass'y (1 point)
(33)	L-1	Set-screw for PTS sensor ass'y (1 point)
(34)	L-1	Set-screw for HP sensor ass'y (1 point)
(35)	L-2	Set-screw for ribbon mask (2 points)
(36)	L-2	Engagement part of carriage ass'y and timing belt (1 point)
(37)	L-1	Part between PTS sensor board and motor heat sinker (2 points)
(38)	L-2	Part between PE sensor board and lower paper guide (2 points)

NOTE: Operation failure of adjacent components, etc. may occur due to leakage of adhesive. To avoid this, pay attention to the amount of adhesive applies. (See Fig. 6-1.)



<To screws> <To PE sensor board> <To timing belt>

Fig. 6-1. Adhesive Application Points

Table 6-5. List of Lubricants And Adhesive

Item	Name	Supply Unit	Type
Lubricant	O-2	40cc	Ⓔ
	G-2	40g	Ⓔ
	G-14	40g	Ⓔ
Adhesive	Neji lock No. 2 (G)	1,000g	○

○ = Ordinary adhesive available commercially

Ⓔ = EPSON exclusive lubricant

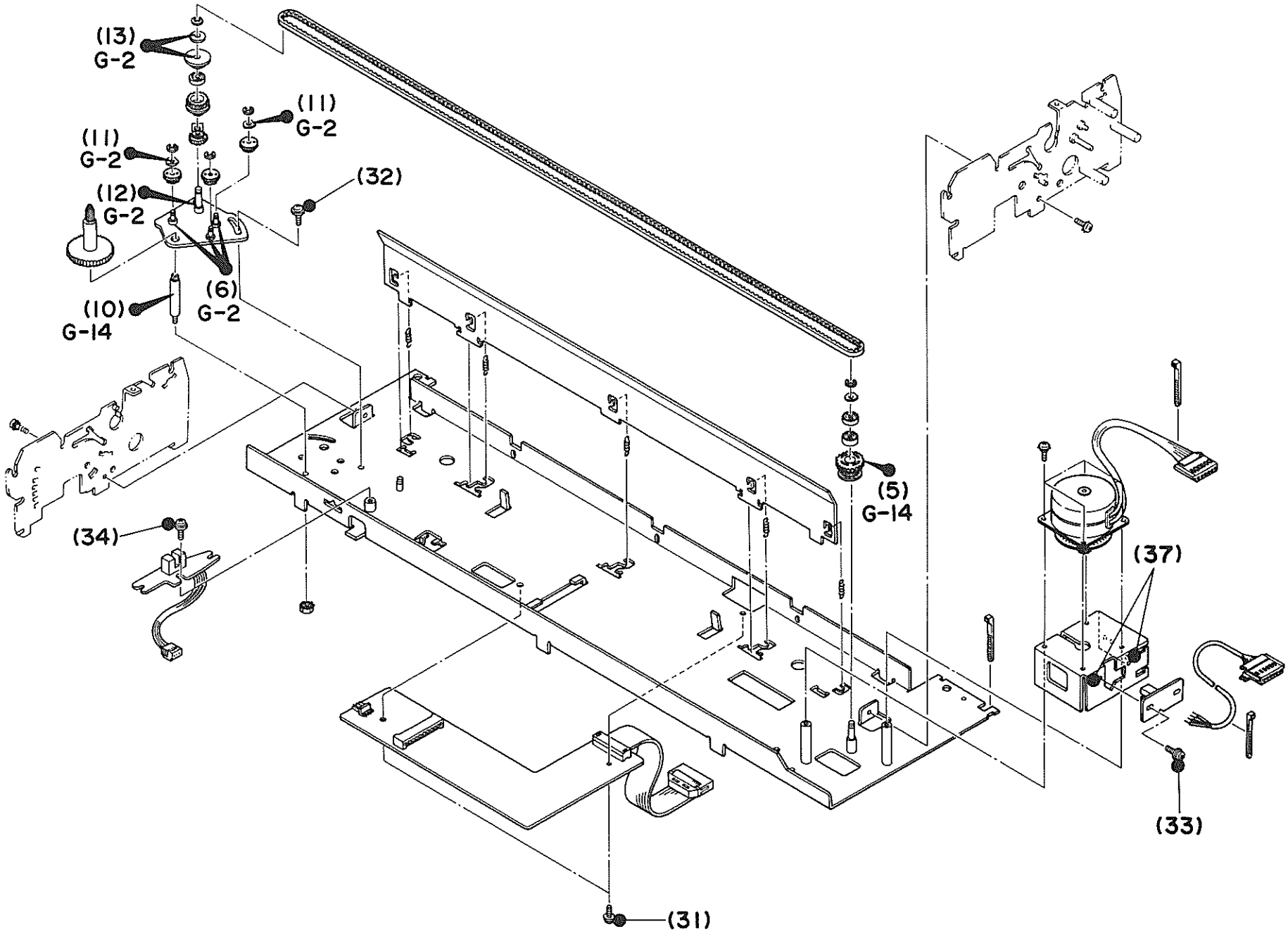


Fig. 6-2. Model-3510 Lubrication and Adhesive Application Points Drawing 1

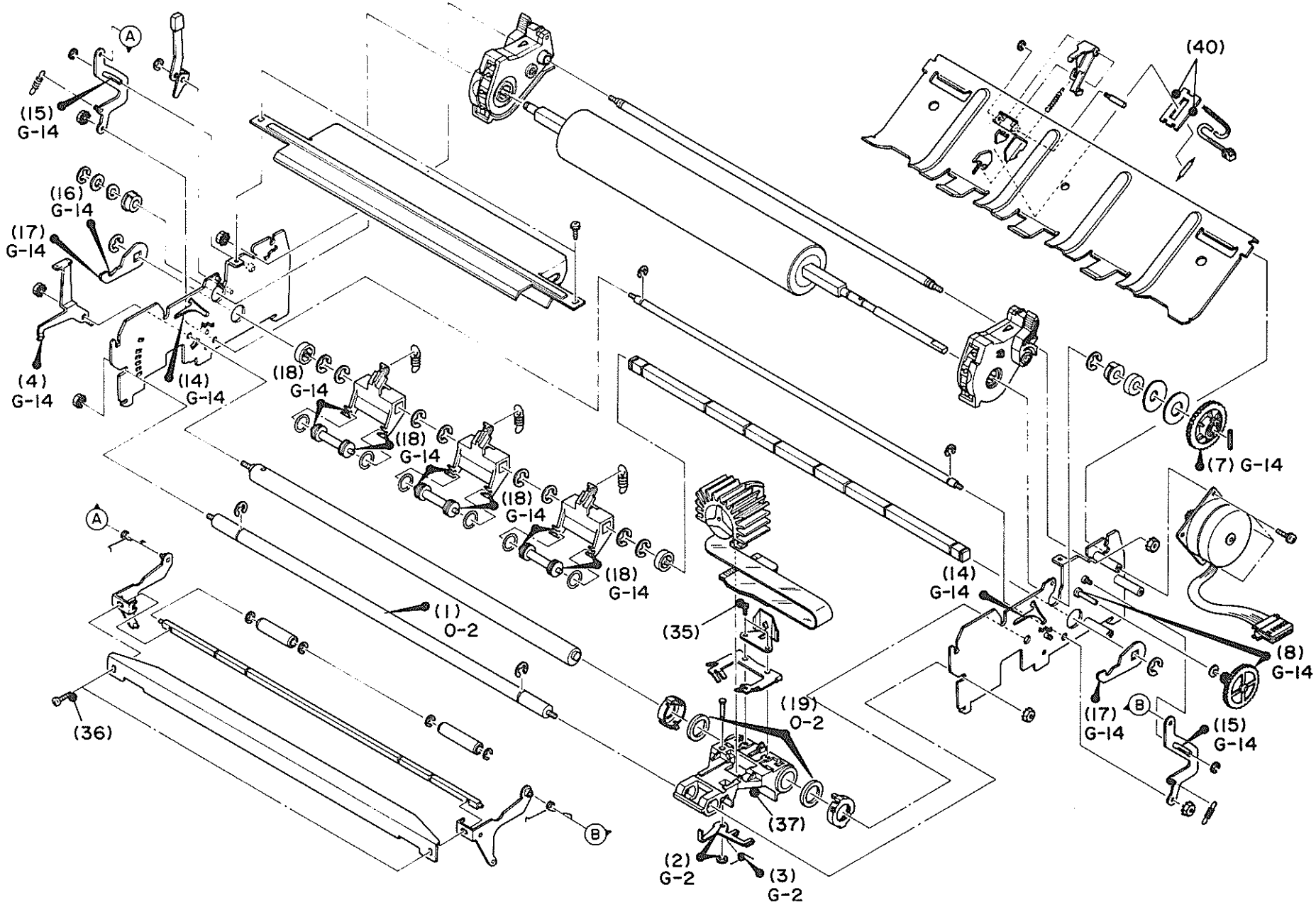


Fig. 6-3. Model-3510 Lubrication and Adhesive Application Points Drawing 2

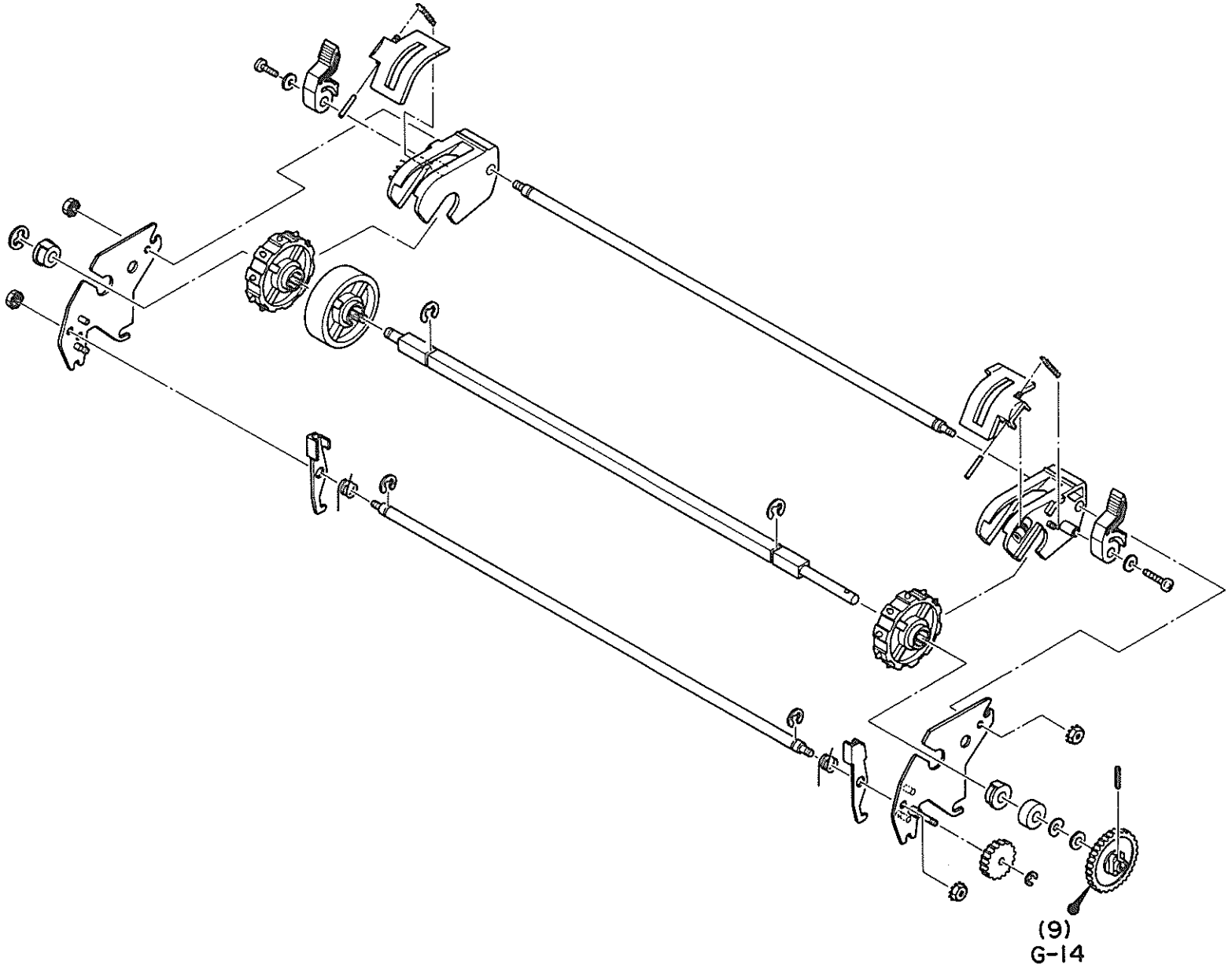


Fig. 6-4. Model-3510 Lubrication and Adhesive Application Points Drawing 3

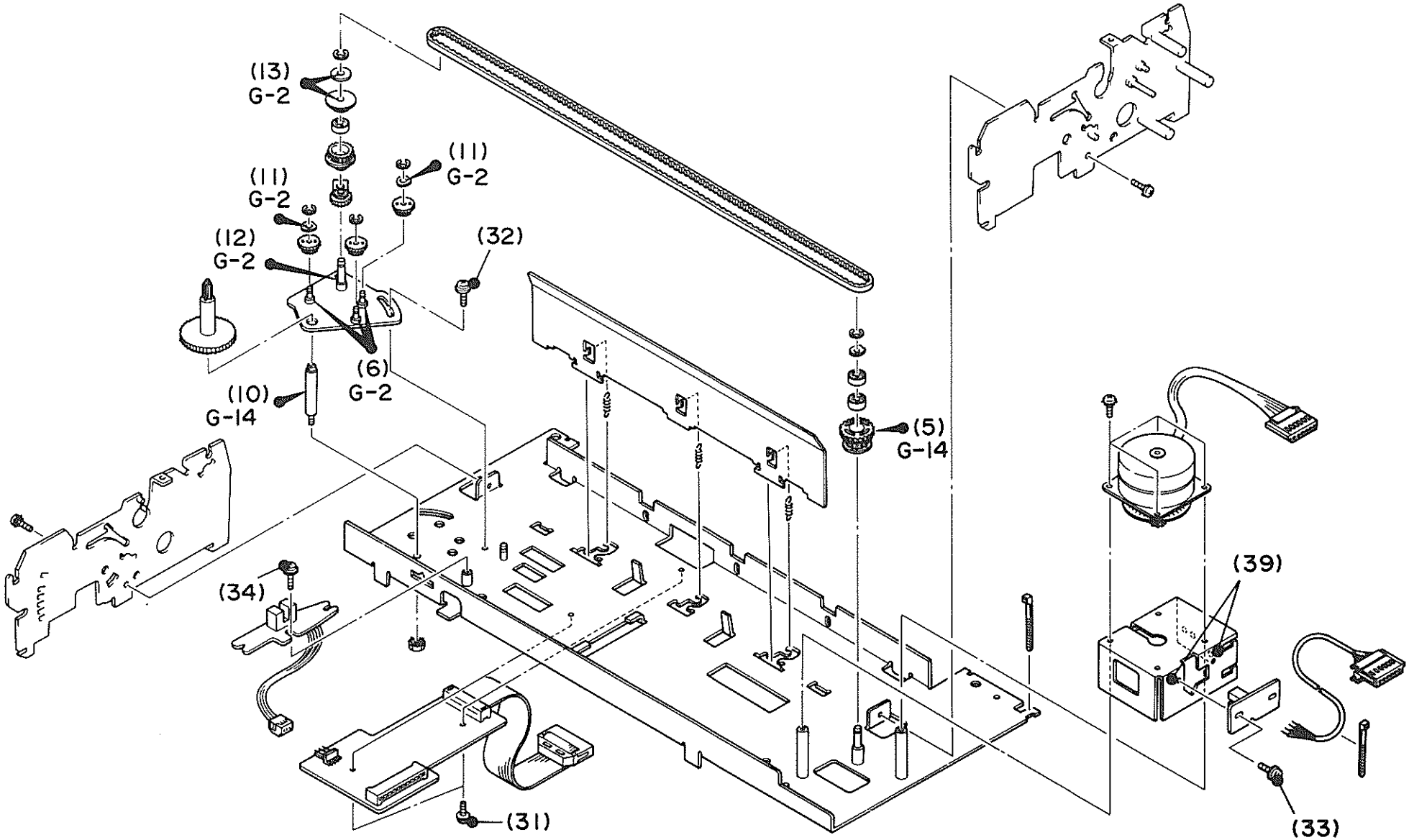


Fig. 6-5. Model-3560 Lubrication and Adhesive Application Points Drawing 4

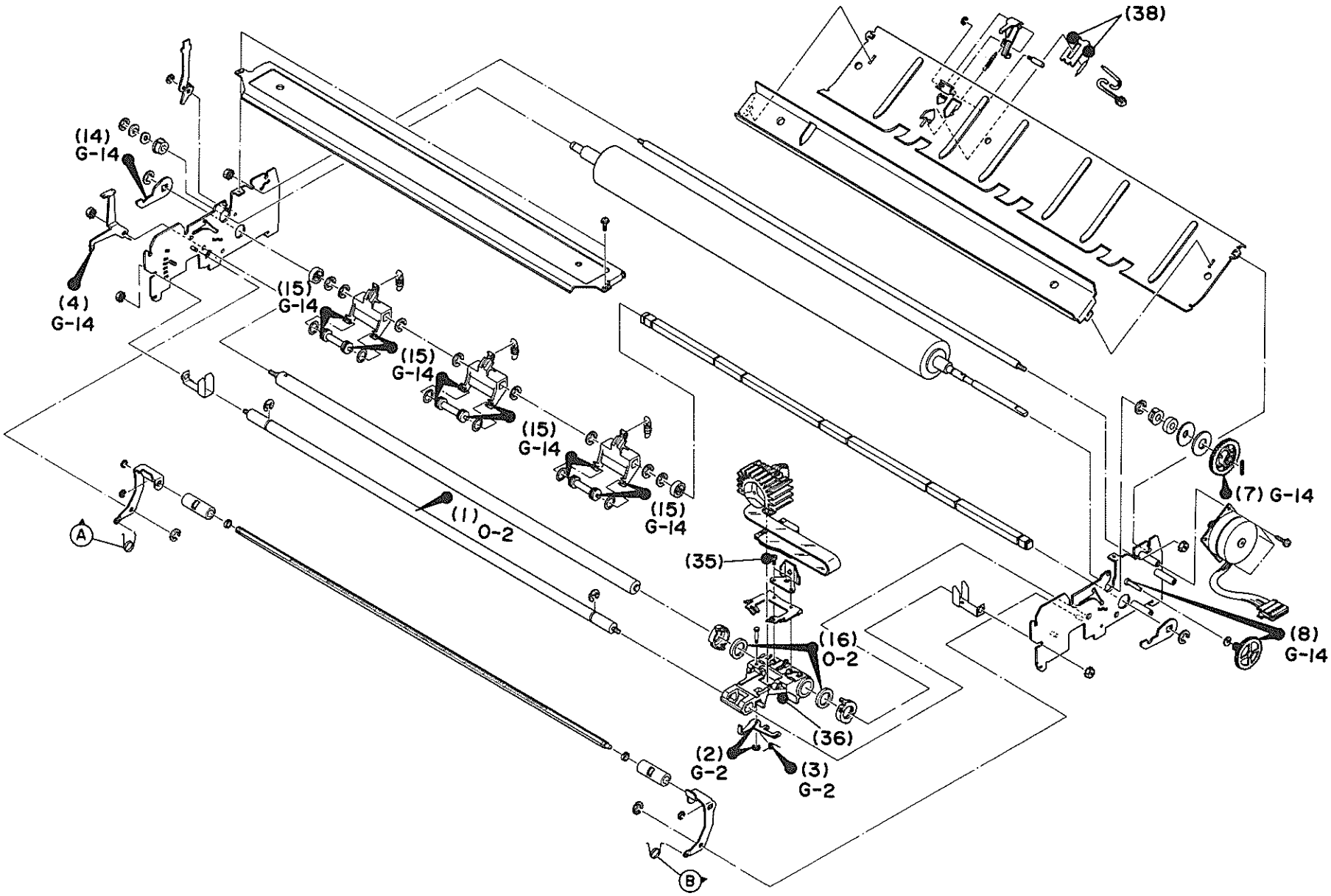


Fig.6-6. Model-3560 Lubrication and Adhesive Application Points Drawing 2

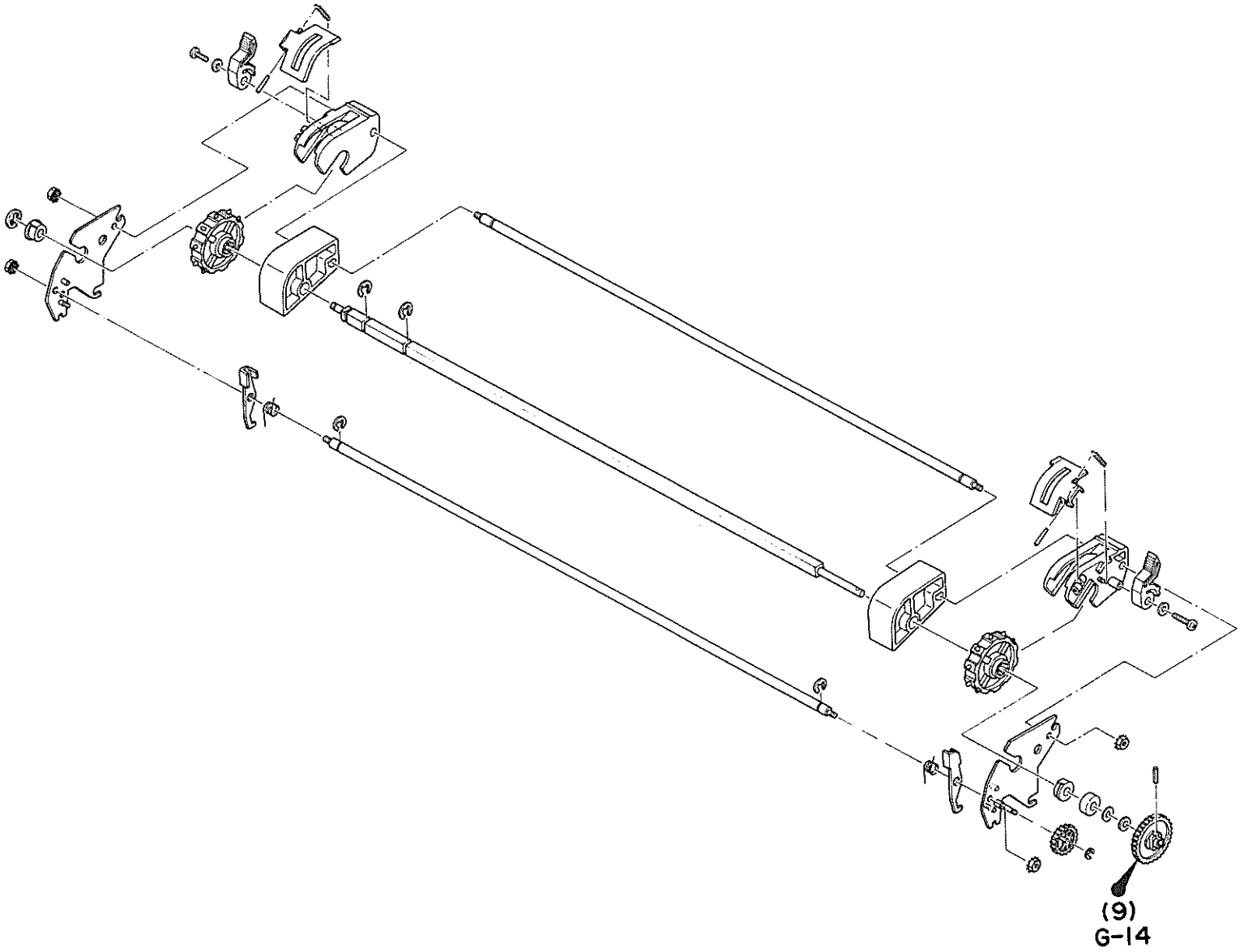


Fig. 6-7. Model-3560 Lubrication and Adhesive Application Points Drawing 3

APPENDIX

Appendix Diagrams

1. Exploded Diagram for FX-80+
2. Exploded Diagram for FX-100+
3. Exploded Diagram for FX-85
4. Exploded Diagram for FX-185 (105)
5. FXMB Circuit Diagram
6. FXEXT Circuit Diagram
7. FXMB Component Layout
8. FXEXT Component Layout

A.1 LIST OF PRINCIPAL ICs

Table A-1. FXMB Circuit Board

Name of IC	Part Number	Type	Location
μPD7810	X400078100	Main CPU	3B
8042-063P	Y440800007	Slave CPU (C42040KB)	9B
27128	———	16K byte P ROM	5A
2764 (FX-85/185/105)	———	8K byte ROM	4A
STK7563	X440756310	Regulator IC	IC1
STK6982	X440759820	Hybrid IC	IC2
μPA79C	X440150790	Transistor Array	1B, 2C, 8C
HA13007	X440170070	Transistor Array	3C
M20214GA (FX-80+/100+)	Y442800101	Fuse ROM	4B
M02016GA (FX-85/185/105)	Y492800101	Fuse ROM	4B
μPD4016D	X400040161	S-RAM	2A, 3A, 4A
TC4584PB	X460458400	C-MOS IC	8A
7406	X420100060	TTL-IC	8B
74LS04	X420300040	TTL-IC	5B, 7C
74LS32	X420300320	TTL-IC	7B
74LS74	X420300741	TTL-IC	6B
74LS373	X420303730	TTL-IC	6A, 7A

Table A-2. FXEXT Circuit Board (FX-85/FX-185/105)

Name of IC	Part Number	Type	Location
27128	———	16K byte PROM	5A
4168	X400041682	8K byte SRAM	1A, 3A
74LS00	X420300000	TTL-IC	1B, 2B, 4B
74LS02	X420300020	TTL-IC	3B
74LS374	X420303740	TTL-IC	5B

A.2 LIST OF PRINCIPAL TRANSISTORS

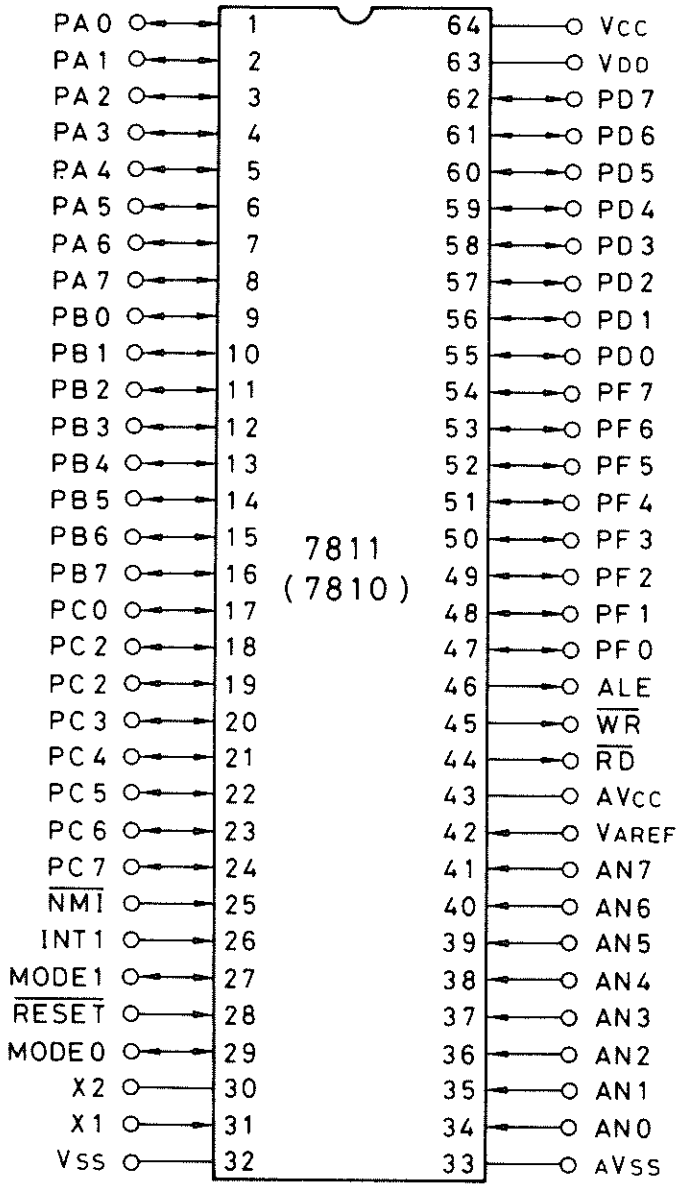
Table A-3. FXMB Circuit Board

Name of Transistor	Part Number	Type	Location
2SA1015	X300101509	PNP 50V 0.1W	Q1, Q2
2SB794	X301079400	PNP 60V 10W	Q15
2SC1815	X302181509	NPN 60V 0.4W	Q3, Q5, Q16 ~ Q18
2SD1218	X303121800	NPN 50V 40W	Q6 ~ Q14
2SD986	X303098600	NPN 80V 10W	Q4

A.3 DESCRIPTION OF PRINCIPAL ICs

A.3.1 μPD7811 (7810)

(1) Terminal Layout



PA7-0	:	Port A	MODE 0.1	:	Mode 0.1
PB7-0	:	Port B	X1, X2	:	Crystal
PC7-0	:	Port C	AN7-0	:	Analog Input
PD7-0	:	Port D	$\overline{RD}$	:	Read Strobe
PE7-0	:	Port F	$\overline{WR}$	:	Write Strobe
$\overline{NMI}$	:	Non-maskable Interrupt	ALE	:	Address Latch Enable
INTI	:	Interrupt Request	$\overline{RESET}$	:	Reset
			VAREF	:	Reference Voltage

Fig. A-1. Pin Assignment (7810/7811)

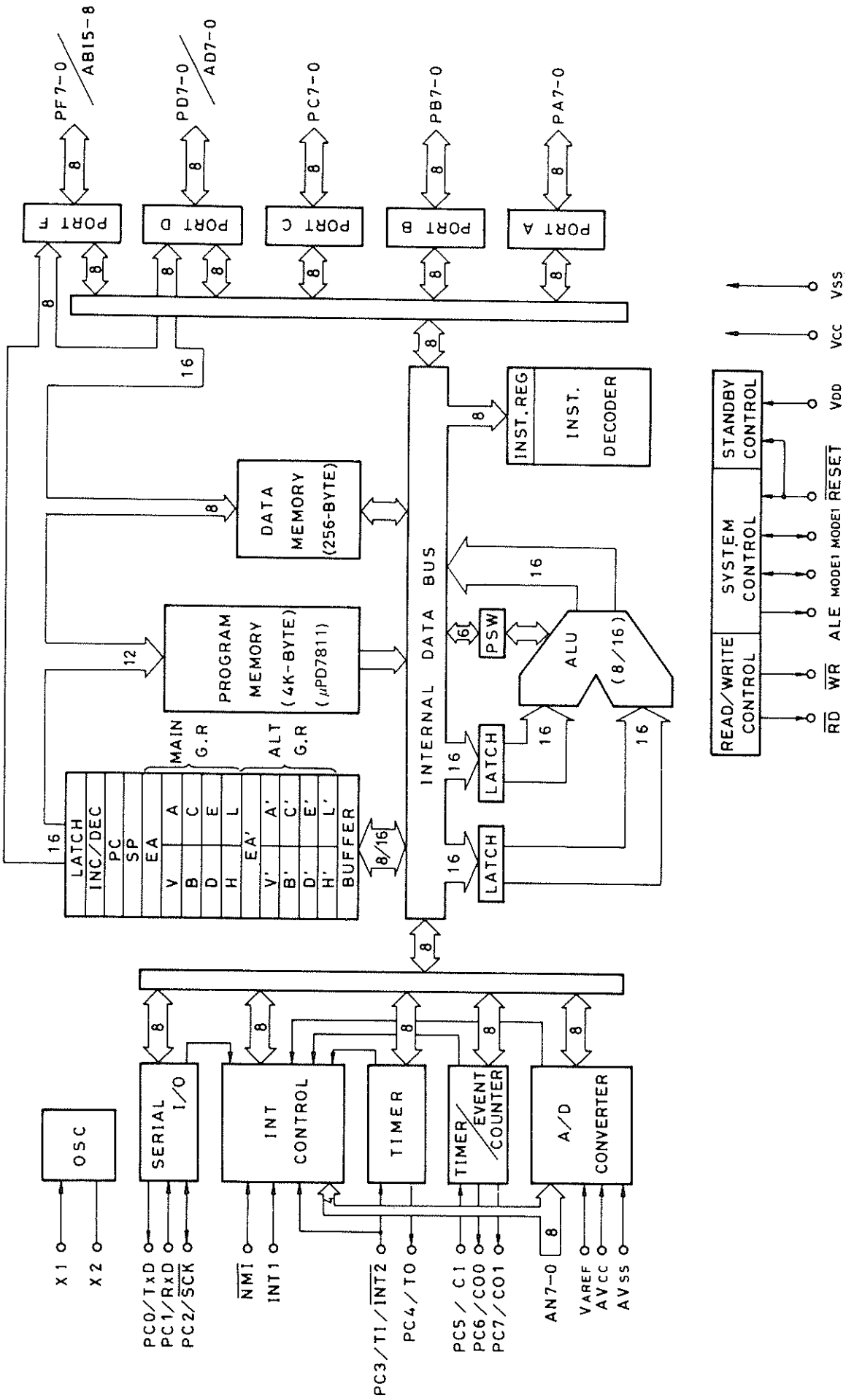


Fig. A-2. Block Diagram (7810/7811)

(2) Features of μPD7811 (7810)

- Instruction.....158 kinds
- Instruction cycle.....1.μs
- Built-in Mask-ROM (μPD7811).....4096 bytes
- Built-in RAM.....256 bytes
- Direct addressing of up to 64K bytes possible
- 8-bit AD converter
- General purpose serial interface.....Asynchronous mode
  Synchronous mode
  I/O interface mode
- 16-bit timer/event counter
- 8-bit timer.....Two
- Interrupt (3 external, 8 internal).....6 level priority
  6 interrupt addresses
- I/O line
  Input/output port.....40 bits (μPD7811)
  Edge detection input.....28 bits (μPD7810)
  4 inputs
- Zero cross detecting function
- Standby function
- Built-in clock pulse circuit
- N MOS

(3) Difference Between μPD7811 And μPD7810

Difference between μPD7811 and μPD7810 lies in the presence or absence of built-in Masked ROM, which causes difference in memory map.

1) μPD7811: Masked ROM at addresses 0 to OFF
   RAM at addresses FFOO to FFFF
2) μPD7810: RAM at addresses FFOO to FFFF

(4) Functins of μPD7811 (7810)

1) Port A: 8-bit input/output port with output latch bit-by-bit input/output is made possible by mode A register (MA).
2) Port B: 8-bit input/output port with output latch bit-by-bit input/output is made possible by mode B register (MB).
3) Port C: 8-bit input/output port with output latch bit-by-bit port/control mode can be set by mode Control C register (MCC).
4) Port D: 8-bit input/output port with output latch
   - 7811
     a) Port mode 8-bit input/output possible
     b) Extension mode: When the memory is extended beyond the built-in memory, PD7-0 act as the multiplex address/data bus (AD7-0).
   - 7810
     a) Port D acts as the multiplex address/data bus to access external memory.
5) Port F: 8-bit input/output port with output latch
   - 7811
     a) Port bit-by-bit input/output possible by mode F register
     b) Extension mode: Gradual address output assignment possible in accordance with the size of memory to be extended externally. See the following table.

Table A-4. Operation of 7811 Port F

PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0	External Memory
Port	Port	Port	Port	Port	Port	Port	Port	256 bytes (max.)
Port	Port	Port	Port	AB11	AB10	AB9	AB8	4K bytes (max.)
Port	Port	AB13	AB12	AB11	AB10	AB9	AB8	16K bytes (max.)
AB15	AB14	AB13	AB12	AB11	AB10	AB9	AB8	60K bytes (max.)

- 7810

a) By setting modes 0 and 1, assignment to the address bus (AB15 to 8) can be made in accordance with the size of memory to be provided externally.
The remaining terminals can be used as input/output ports.
See the following table.

Table A-5. Operation of 7810 Port F

MODE1	MODE0	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0	External Memory
0	0	Port	Port	Port	Port	AB11	AB10	AB9	AB8	4K bytes
9	1	Port	Port	AB13	AB12	AB11	AB10	AB9	AB8	16K bytes
1	1	AB15	AB14	AB13	AB12	AB11	AB10	AB9	AB8	64K bytes

6) $\overline{WR}$ (Write Strobe).....Output
Strobe signal for write operation of external memory.
HIGH level at times other than the data write machine cycle of external memory and at reset.

7) $\overline{RD}$ (Read Strobe).....Output
Strobe signal for read operation of external memory.
HIGH level at times other than the read machine cycle of external memory and at reset.

8) ALE (Address Latch Enable).....Output
Strobe signal to latch the lower 8 bits of address to access external memory.

9) MODE 0, MODE 1 (Mode).....Input/Output
- 7811: Mode 0 is set at LOW level and Mode 1 at HIGH level.
- 7810: Mode 0 and Mode 1 are set in accordance with the size of external memory.

Table A-6. Mode Setting (7810/7811)

Mode 1	Mode 0	External memory
0	0	4KB Addresses 0 to OFFF
0	1 (Note)	16KB Addresses 0 to 3FFF
1 (Note)	1 (Note)	64KB Addresses 0 to FEFF

(Note) pull-up is made

Functions of Mode 0 and Mode 1

The following two functions are made possible by pulling up the Mode terminal:

Mode 0: Output of $\overline{IO}$/M in synchronism with ALE

Mode 1: Output of $\overline{MI}$ in synchronism with ALE

10) $\overline{NMI}$ (Non-maskable Interrupt).....Input
Non-maskable interrupt of the edge trigger (trailing edge)

11) INTI (Interrupt).....Input
Maskable interrupt input of the edge trigger (leading edge). It can also be used as the AC input zero cross detecting terminal.

12) AN7-0 (Analog Input).....Input
8 analog inputs of A/D converter. And AN7 to 4 can be used as the input terminals to detect the leading edge and to set the test flag upon detection of the trailing edge.

13) VAREF (Reference Voltage).....Input
Reference voltage input of the A/D converter

14) AVcc (Analog VCC)
Power terminal of the A/D converter

15) AVss (Analog Vss)
GND terminal of the A/D converter

16) VDD
Power supply to the built-in RAM which supplies +5V during normal operation and standby.

17) X1, X2 (Crystal)
Crystal connection terminal for built-in clock pulse. When the clock pulse is supplied from outside, input must be made to X1.

18) $\overline{RESET}$ (Reset)
Reset input at LOW level
At the reset input, the conditions of respective ports are as follows:

Port A:	Input port (Output high impedance)
Port B:	Input port (Output high impedance)
Port C:	Input port (Output high impedance)
Port D	
(a) μPD7811:	Input port (Output high impedance)
(b) μPD7810:	Address output at PD7 to 0
Port F	
(a) μPD7811:	Input port (Output high impedance)
(b) μPD7810:	Terminal designated by address bus is for address output. Port terminal becomes an input port.

(5) CPU Timing

- 3 cycles of oscillation frequency are defined to be one state.
- One machine cycle requires 3 states for read or write operation, and OP code fetch requires 4 states.
- Wait state cannot be inserted.

1) OP Code Fetch Timing (See Fig. A-3)
Four states (T1 – T2) constitute the OP code fetch timing. During T1 to T3 program memory is read; instructions are interpreted during T4.
AB15 to 8 (PF 7 to 0) are output to T1 – T4.
AD7 to 0 (PD7 to 0) are used in the multiplex mode; in this mode, the address is latched during T1 at the ALE signal. Since the memory addressed is enabled after disagling the driver, AD7 to 0, RD si output to T1 to T3, feteched at T3 and processed internally at T4.

2) Memory Read Timing (See Fig. A-4)
Memory read is performed during T1 to T.
ALE and RD signals are executed from T1 to T3; Op code fetch for these two signals is performed at T4.

3) Memory Write Timing (See Fig. A-5)

Memory write is performed during T1 to T3.

The Address and ALE signal timing is the same as for memory read. However, following address output, AD7 to 0 (PD7 to 0) are not disabled, and write data are output at AD7 to 0 from the beginig of T1 to the end of T3.

The WR signal is output from the middle of T1 to the start of T3.

NOTE: Where PD7 to 0 are set to the multiplex address/data bus (AD7 to 0) and PF7 to 0 to the address bus (AB15 to 7), the $\overline{RD}$ and $\overline{WR}$ signals in the machine cycle not accessing external memory are both at HIGH level.

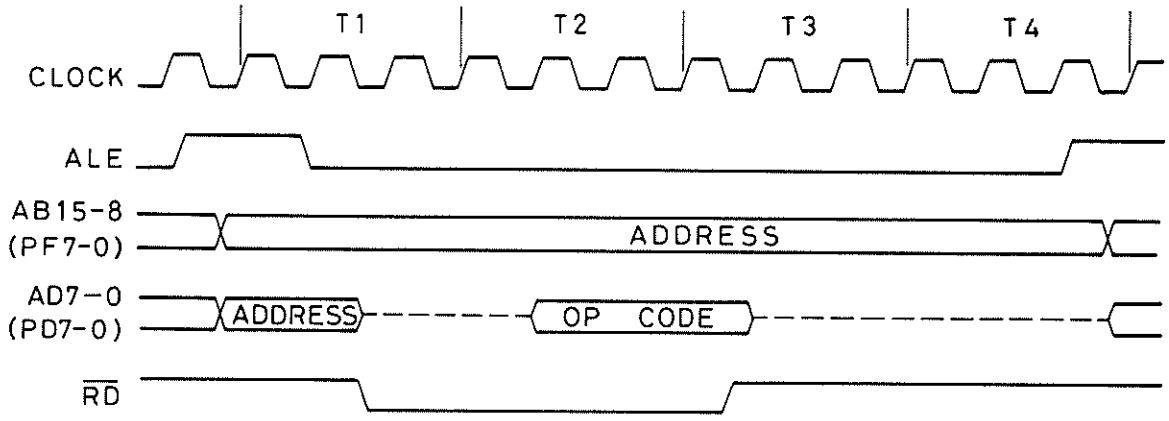


Fig. A-3. OP Code Fetch Timing

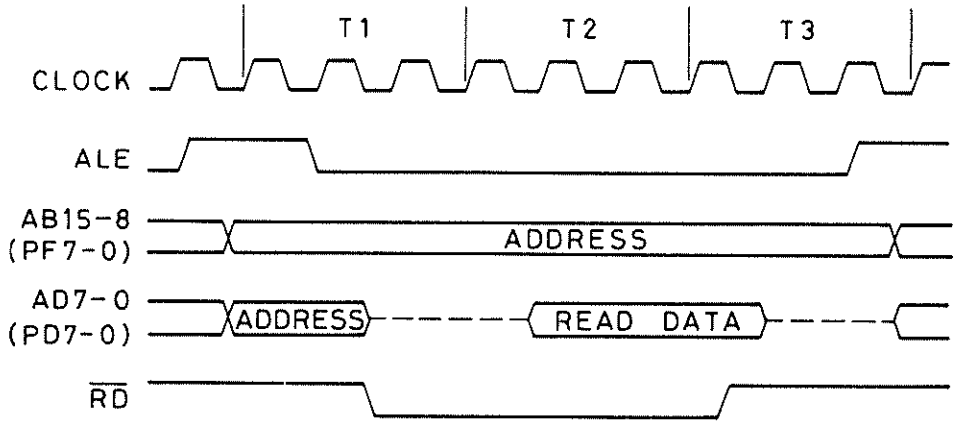


Fig. A-4. Memory Read Timing

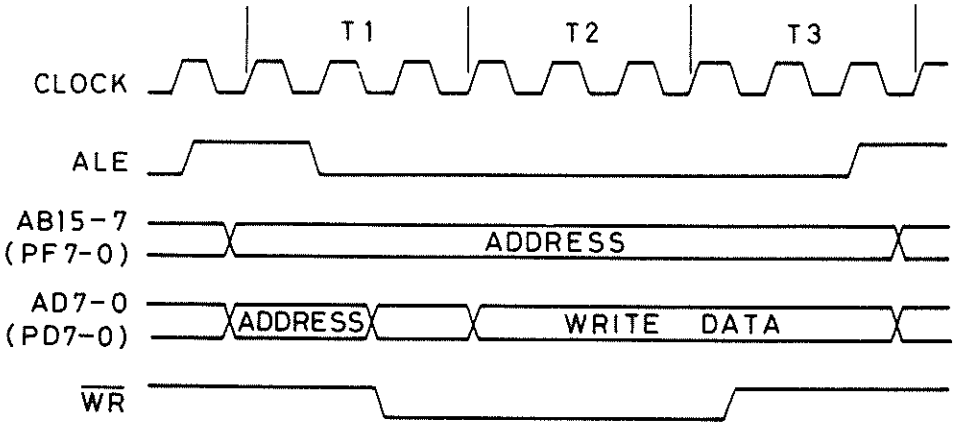


Fig. A-5. Memory Write Timing

A.3.2 μPD8042/8742 (μPD8041/8741)

(1) Terminal Layout

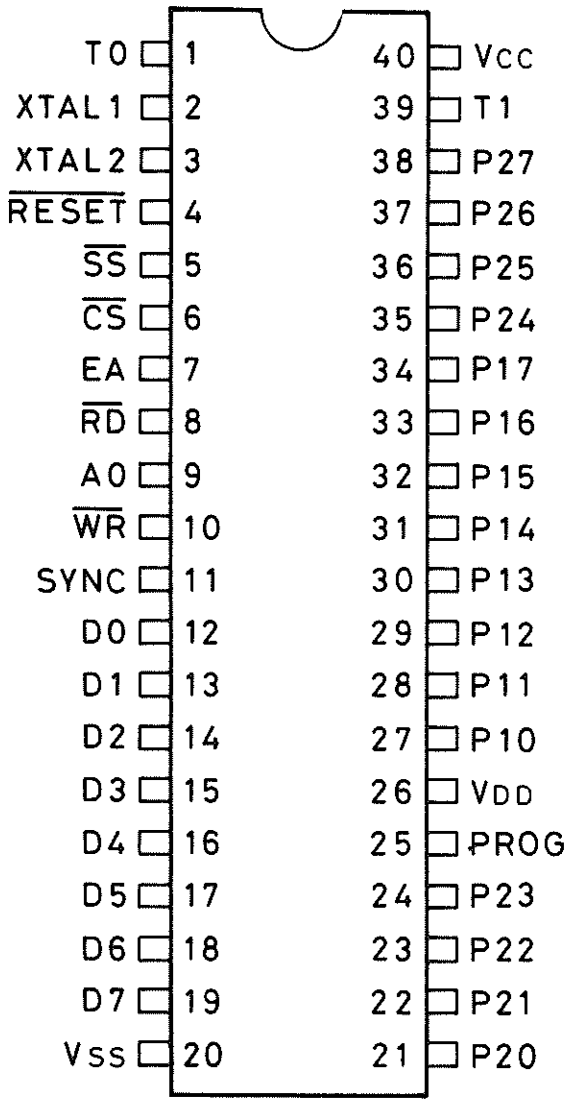


Fig. A-6. Pin Assignment (8042)

XTAL1, XTAL2	:	Crystal
RESET	:	Reset
T0	:	Test Input 0
EA	:	External Address
D7 – D0	:	Data Line (Lower Address Line)
P22 – P20	:	Higher Address
RROG	:	Program Pulse Input Terminal

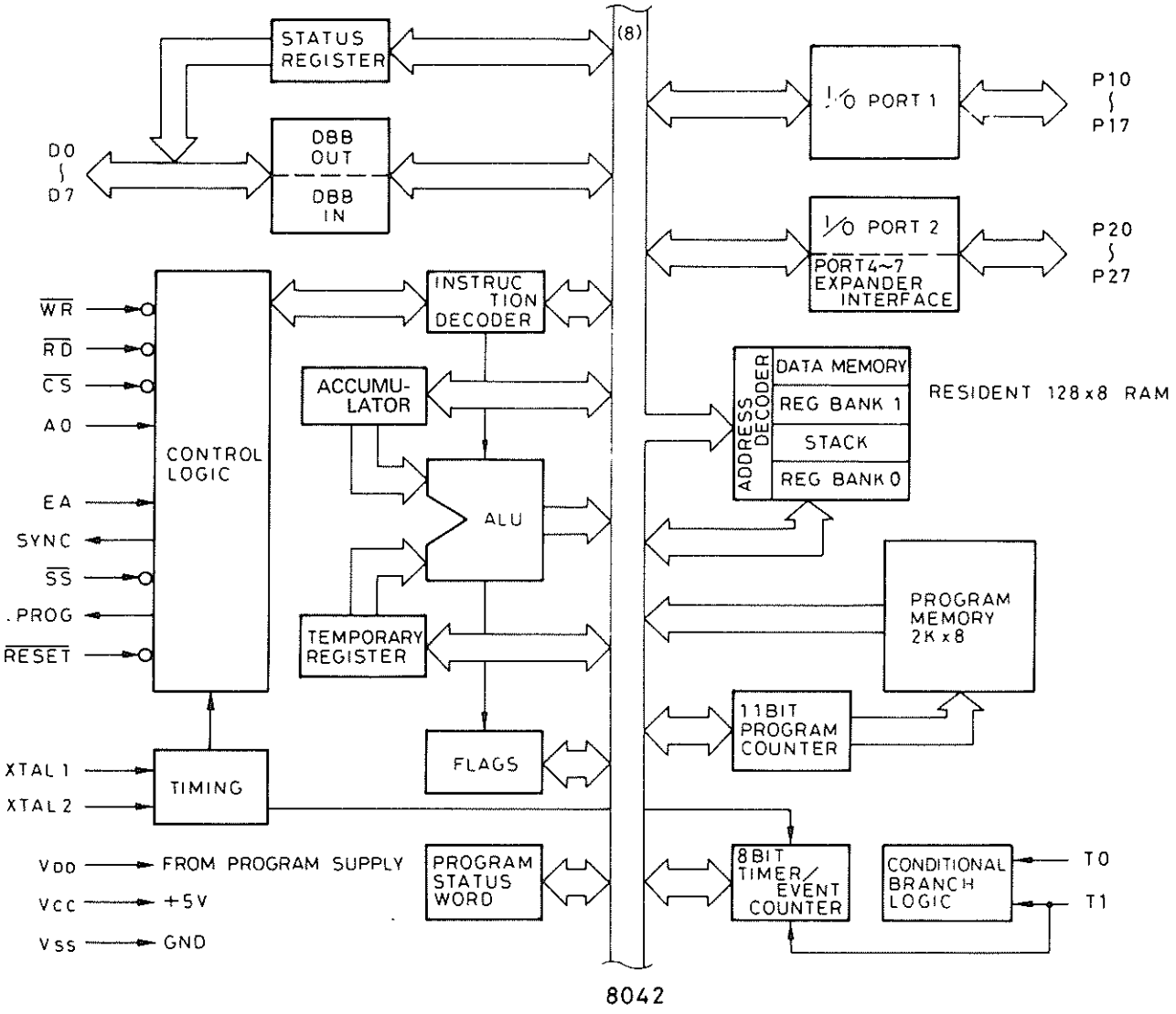


Fig. A-7. Block Diagram (8042)

(2) Features of 8042/8742 (8041/8741)

- 8-bit microprocessor unit
- Built-in 2-kbyte ROM (1K byte ROM)
- Built-in 128-byte RAM (64 byte RAM)
- 8-bit I/O port (2 sets)
- Two test input lines
- Built-in 11-bit program counter (10 BIT)
- Built-in 8-bit timer/counter
- Built-in clock generator
- 8-bit status register
- Two data buffer registers
- 93 kinds of instructions
- DMA handshake interrupt request function

(3) Terminal Functions of 8042/8742 (8041/8741)

- T0, T1 (Test Input 0, 1).....Input
  Input terminals for testing by conditional branch instruction.
  T1 serves also for the event input of the event counter.
- XTAL 1, 2 (Crystal 1, 2)
  Crystal connection terminals for built-in clock oscillation
- RESET.....Input
- $\overline{SS}$ (Single Step).....Input
  Terminal for control of single step operation. When signal is LOW, the MPU stops upon completion of the command being executed.
- $\overline{CS}$ (Chip Select).....Input
  Chip select for selection of UPI.
- EA (External Access).....Input
  Terminal for emulation and test of the UPI. At the input of LOW or HIGH level in normal operation, the UPI enters the test mode.
- $\overline{RD}$ (Read Strobe).....Input
  Strobe signal for the master processor to read out output data buffer register or status register.
- A0 (Address 0).....Input
  A0 = L: Read-out of data from output data bus buffer register or write-in of data to input bus buffer register
  A0 = H: Read-out from status register or write-in of command to input data bus buffer register
- $\overline{WR}$ (Write Strobe).....Input
  Strobe signal for the master processor to write data or command in input data bus buffer register
- SYNC (Synchronism)
  Signal output for an instruction cycle. SYNC output is used as a strobe signal to external circuits. It is also used to synchronize single step operation.
- D0 to D7 (Data).....Input/Output
  8-bit bidirectional data bus.
  The data bus is in high impedance, except when the master processor is reading out the UPI.

- P20 to P27 (I/O port 2).....Input/Output

  In addition to the ordinary functions of the I/O ports, there are the following functions:

  The lower four bits (P20 to P23) can also serve as the interface ports with the μPD8243 I/O expander. When the expanded I/O ports (Ports 4 to 7) are accessed, the address, command and data are transmitted. At single step operation, the higher three bits of program fetch address are output to P22 and P20.

  By software control, the following higher four bits (P24 to P27) can be used as the terminals for interrupt request and DMA (Direct Memory Access) handshake:

  P24: OBF (Output Data Bus Buffer Register Fu11) output terminal
  P25: $\overline{IBF}$ (Input Data Bus Buffer Register Fu11) output terminal
  P26: DRQ (DMA Request) output terminal
  P27: $\overline{DACK}$ (DMA Acknowledge) input terminal

- PROG (Program).....Input/Output

  Strobe signal to the 8243 I/O expander.

  This terminal serves as the input terminal of program pulse at write to the ROM inside the 8742 (with built-in EPROM).

- VDD

  +5V power source for the built-in RAM

- P10 to P17 (I/O Port 1).....Input/Output

  8-bit bidirectional I/O port.

  At single step operation, these terminals serve as the output terminals for the lower 8 bits of program fetch address.

- T1 (Test 1)
- VCC (+5V Power Supply Terminal)

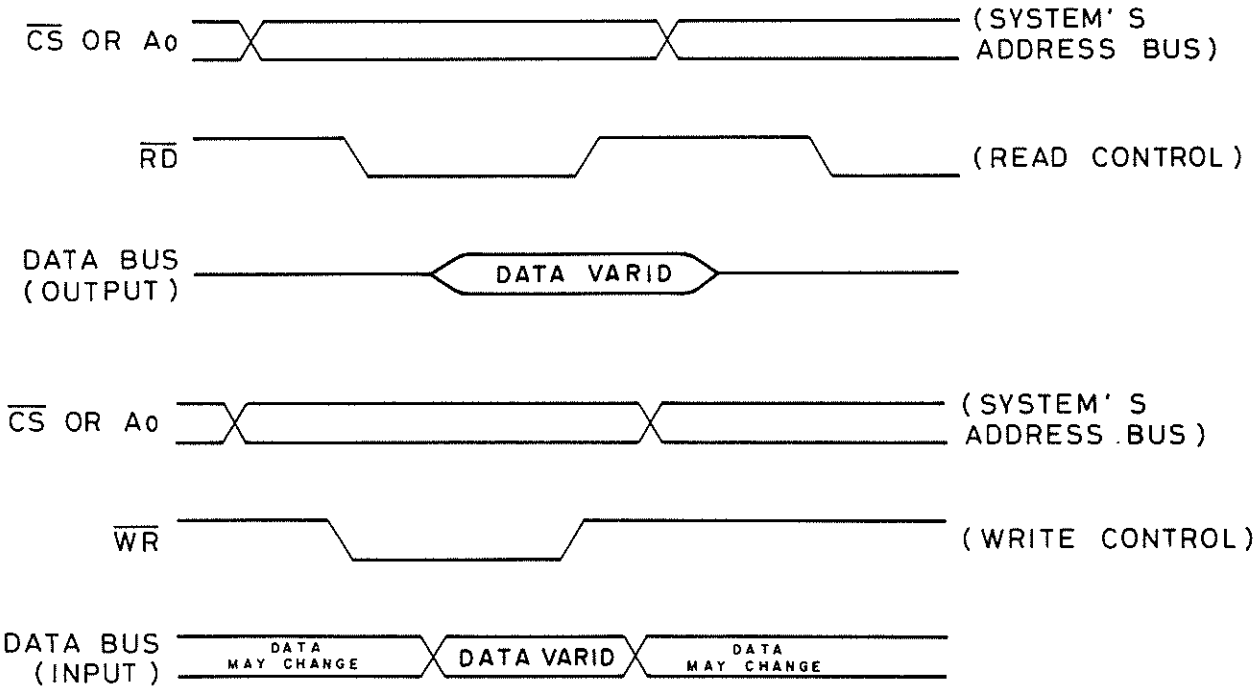


Fig. A-8. Timing Diagram Of 8042/8742 (8041/8741)

A.3.3 128K (16K × 8) EPROM 27128

- 16,324W × 8 configuration
- Access time, 250 ns max.
- Low-power standby mode
- I/O, TTL compatible
- N-channel MOS
- Single power supply, +5V
- 28-pin ceramic DIP

Names and functions of pins

$A_0 - A_{13}$:	Address
$\overline{CE}$:	Chip enable
$\overline{OE}$:	Output enable
$O_0 - O_7$:	Output
$\overline{PGM}$:	Program

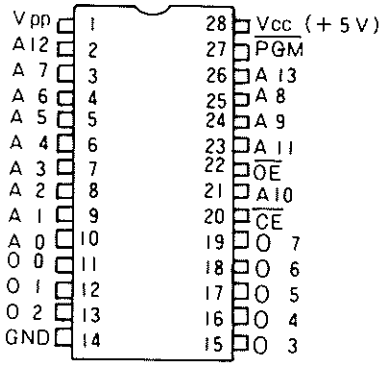


Fig. A-9. Pin Assignment (27128)

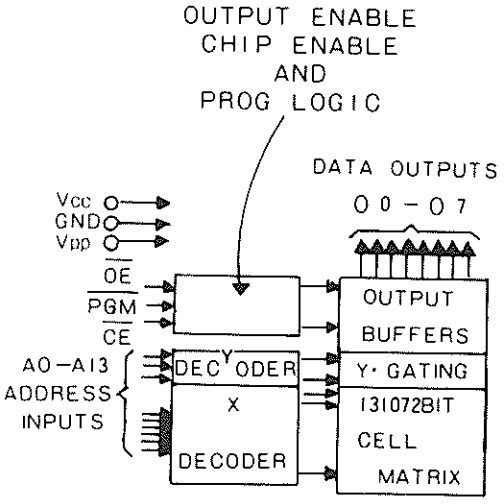


Fig. A-10. Block Diagram (27128)

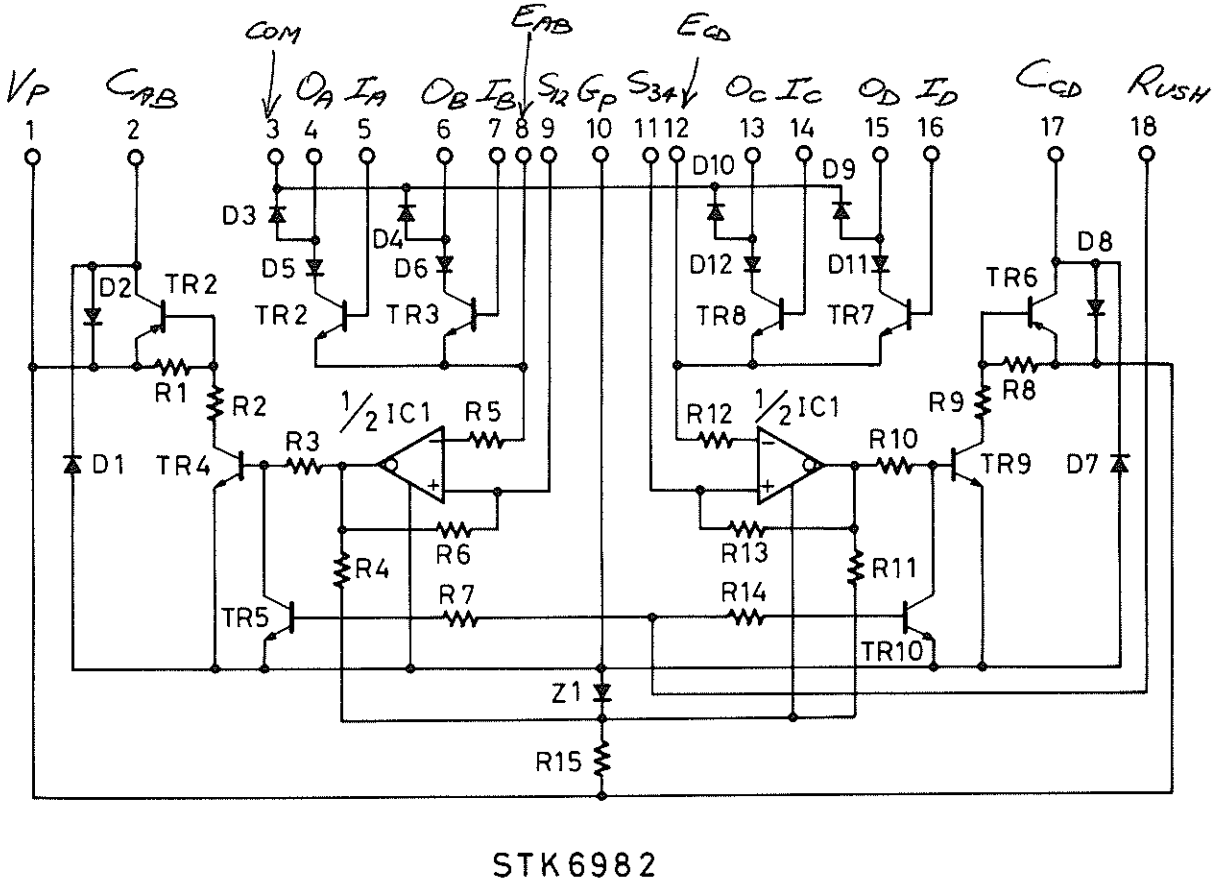
Table A-7. Signal Status (27128)

Mode \ Pin	$\overline{CE}$	$\overline{OE}$	$\overline{PGM}$	Vpp	Vcc	Output (11 ~ 13, 15 ~ 19)
Read	L	L	H	Vcc	Vcc	D_{OUT}
Stand-By	H	X	X	Vcc	Vcc	High Impedance
Program	L	X	L	Vpp	Vcc	D_{IN}
Program Verify	L	L	H	Vpp	Vcc	D_{OUT}
Program Inhibit	H	X	X	Vpp	Vcc	High Impedance

A.3.4 IC STK6982 Thick Film

Names and functions of pins

Vp:	Power supply
C_{AB}:	Common AB, common power supply line
C_{CD}:	Common CD, common power supply line
COM:	Common With Zener diodes connected to this pin, the voltages at pins O_A – O_D can be clamped.
I_A – I_D:	Input pins to which signals are entered to turn ON or OFF transistors TR2, TR3, TR7 and TR8 with TTL level.
O_A – O_D:	Load connection pins Loads are connected between these and pin C_{AB} or C_{CD}.
E_{AB}, E_{CD}:	Pins with logic signal ground level
S_{12}, S_{34}:	Pins with reference voltage With this level of reference voltage, it is possible to restrict the amount of power supplied to loads.
HOLD:	Control signal input pins to hold transistors TR4 and TR9 When this pin is made H, TR5 and TR11 turn ON. TR4 and TR9 turn OFF since their bases become L. TR2 and TR6 thereby turn OFF so that no power (Vp) is supplied to the loads.



STK6982

Fig. A-11. Equivalent Circuit (STK6982)

A.3.5 HA13007 Quad Driver

- Dielectric strength 50V, max. output current 0.7 A
- Low saturation voltage between collector and emitter
- Input, TTL compatible
- Surge absorption diode against inductive load incorporated
- Small input current

Names and functions of pins

OUT A – OUT D: Output

IN A – IN D: Input

ENABLE: Enable
When this pin is HIGH, this chip (HA13007) becomes effective.

CLAMP: Clamp
With Zener diodes connected to this pin, the voltages at OUT A – OUT D can be clamped.

HA13007 is a monolithic bipolar type, high-voltage, large-current quad driver, suitable for interface with high voltage or large current as in peripheral equipment, relay, solenoid, stepping motor, etc., including low-level logic operation.

Table A-12. Truth Table (HA13007)

ENABLE	IN	OUT
H	H	L
H	L	H
L	X	H

for each input:

H = High level; 2.0V

L = Low level ; 0.8V

K = Irrelevant

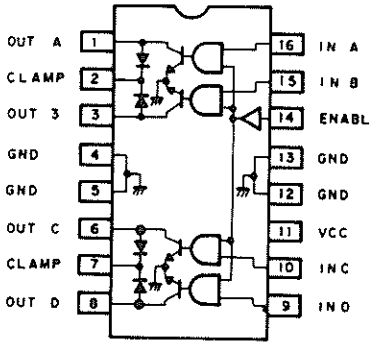


Fig. A-12. Pin Assignment (HA13007)

A.3.6 μPA79C Silicon Transistor Array

- Low output saturation voltage
- High DC current amplification factor
- Reverse bias protection diode incorporated in input side
- Surge absorption diode incorporated in output side

I	:	Input (Base)
O	:	Output (Collector)
GND	:	Common (Emitter)
Vcc	:	Supply Voltage

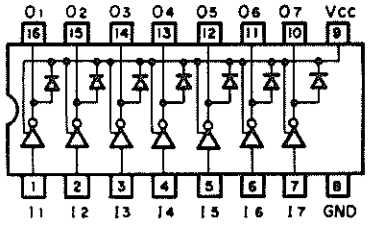


Fig. A-13. Pin Assigment (μPA79C)

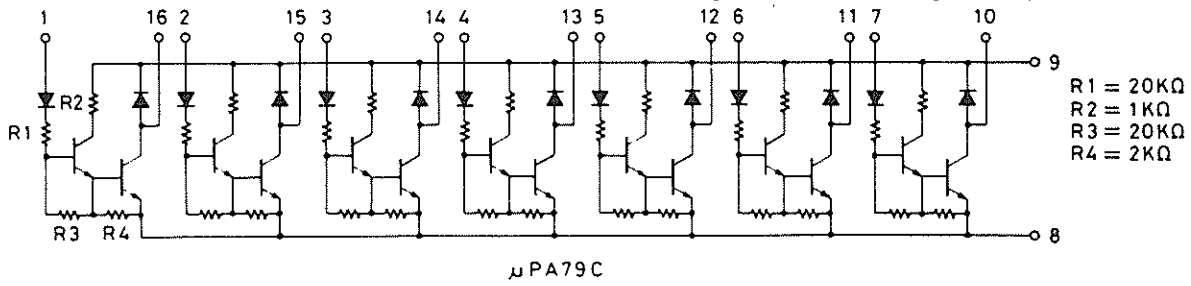


Fig. A-14. Equivalent Circuit (μPA79C)

μPA79C is a transistor array in which a 7-circuit configuration with NPN silicon transistors, diodes and peripheral resistors is made into a monolithic IC. As this device, with low output saturation voltage, can drive about 100 mA load with MOS IC output signal, it is most suitable for the low-voltage drive type printer driver.

Names and functions of pins

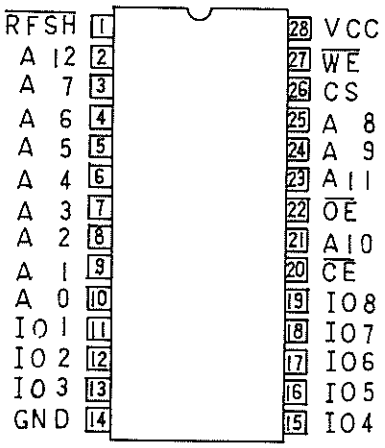
$I_1 - I_7$:	Input pins
$O_1 - O_7$:	Output pins

A.3.7 4168 (8-kbyte Static MOS RAM)

Features

- 8192 word x 8 bits
- **Single power supply of 5** ± 10%
- Pulse refresh and power-down self-refresh possible
- All I/O's TTL compatible
- PC board voltage generator circuit incorporated
- Low power consumption

Pin configration



$A_0 - A_{12}$:	Address Input
$I/O_1 - I/O_8$:	Data I/O
$\overline{CE}$:	Chip Enable
CS:	Chip Select
$\overline{RFSH}$:	Refresh Input
$\overline{WE}$:	Write Enable
$\overline{OE}$:	Output Enable
Vcc:	+5V power supply
GND:	Ground

Fig. A-15. Pin Assignment (4168)

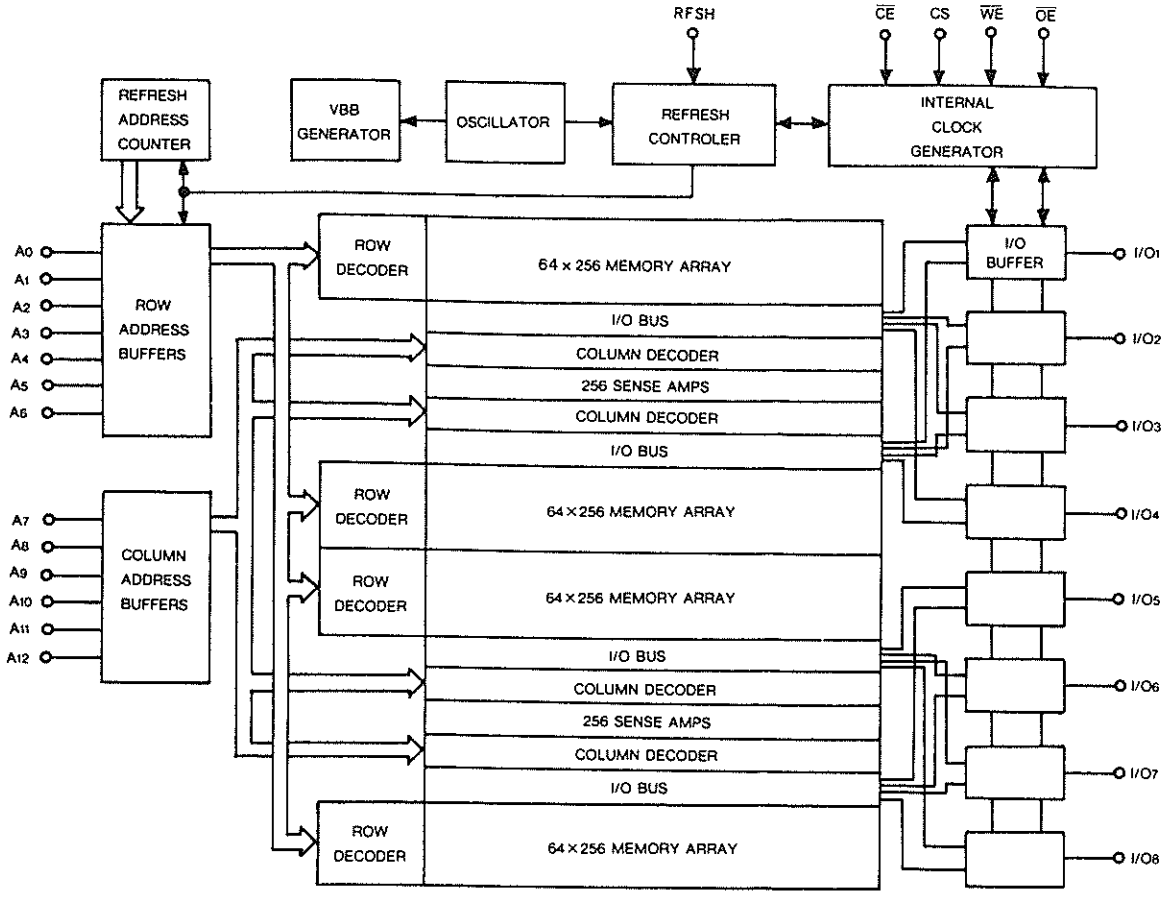


Fig. A-16. Block Diagram (4168)

A.3.8 74LS74 (Preset Clear, D Flip-Flop)

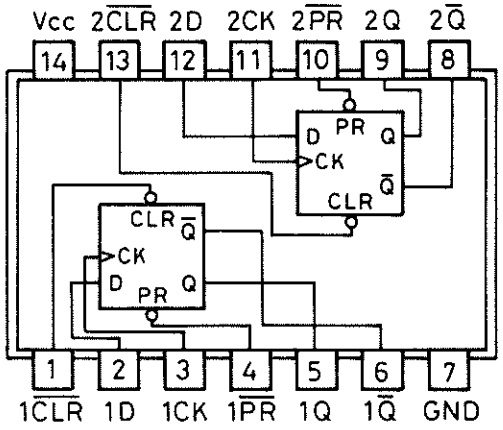


Fig. A-17. Pin Assignment (74LS74)

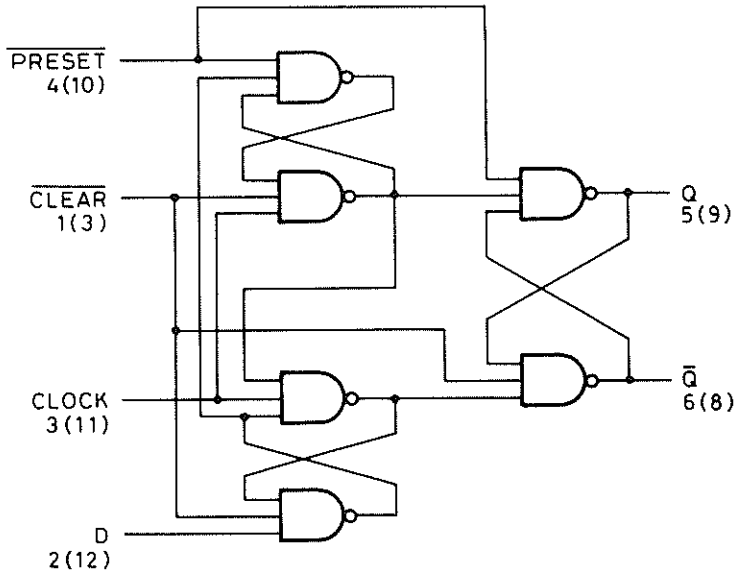


Fig. A-18. Equivalent Circuit (74LS74)

- Leading edge trigger POS type
- Q = HIGH when LOW is added to $\overline{\text{PRESET}}$
- $\overline{Q}$ = HIGH when LOW is added to $\overline{\text{CLEAR}}$
- At read-in of data by F/F, time more than tsu and thold must be taken before and after the clock edge.

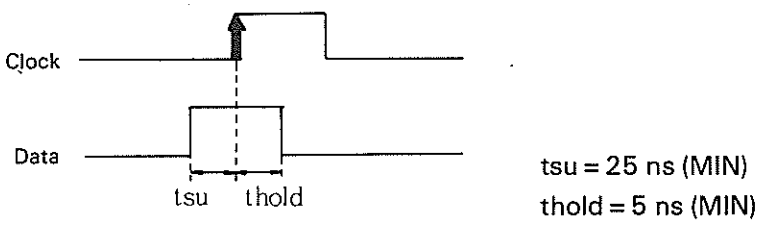


Fig. A-19. Data Latch Timing (74LS74)

A.3.9 74LS125 (Quad Bus Buffer Gates)

74LS125 is a 3-state buffer with four independent output control inputs.

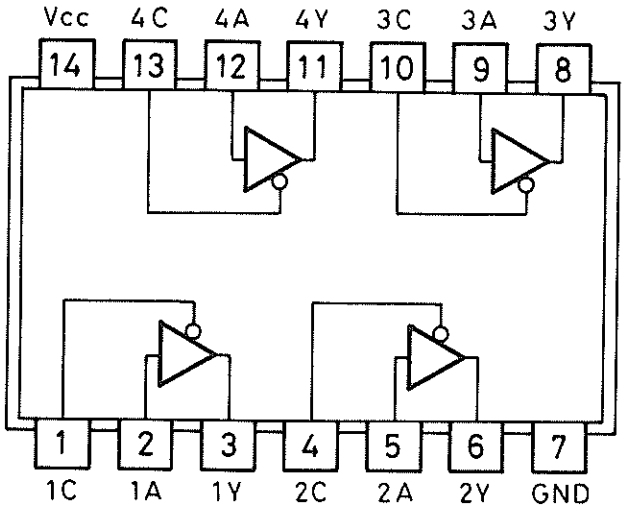


Fig. A-20. Pin Assignment (74LS125)

Table A-8. Truth Table (74LS125)

INPUT		OUTPUT
C	A	Y
H	X	Z
L	L	L
L	H	H

Note: H: High level
L: Low level
X: High or Low
Z: High impedance

A.3.10 74LS139 (Dual 2-4 Decoder/Demultiplexer)

74LS139 is a dual 2 – 4 decoder/demultiplexer which has two entirely independent decoder/demultiplexer facilities, each with 2 input lines and 4 output lines, in one package. The data on one of the 4 output lines is decoded according to the conditions of the 2 binary select inputs and one enable input.

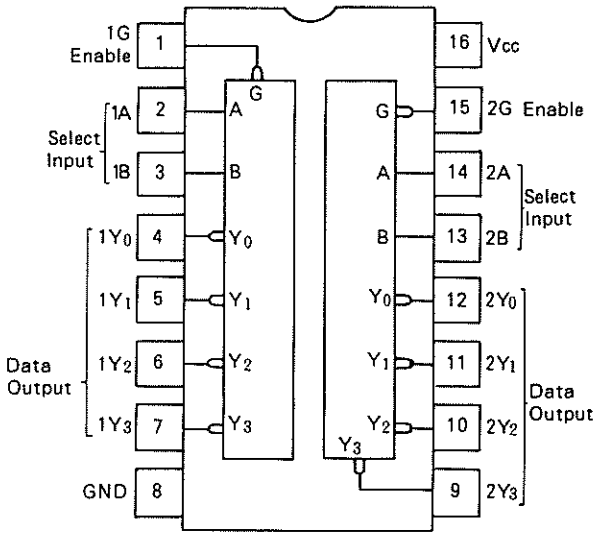


Fig. A-21. Pin Assignment (74LS139)

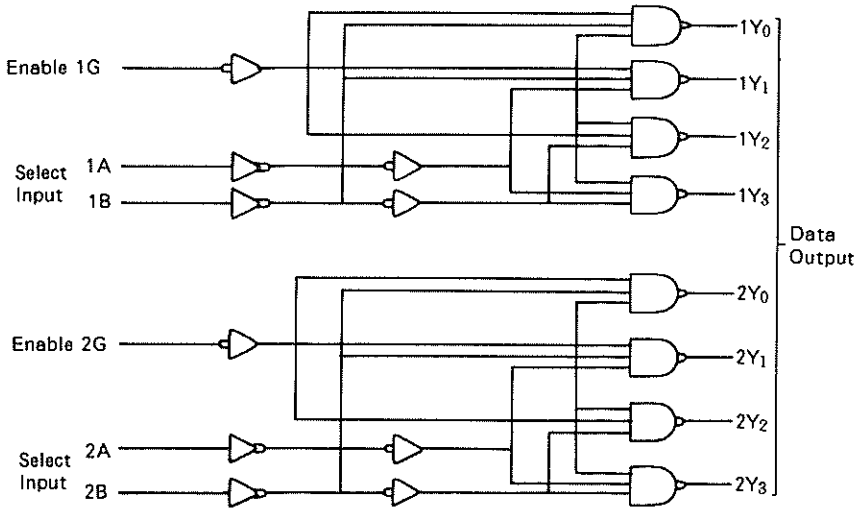


Fig. A-22. Equivalent Circuit (74LS139)

Table A-9. Truth Table (74LS139)

Input			Output			
Enable	Select					
G	B	A	Y_0	Y_1	Y_2	Y_3
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

NOTE: 1. X: High or Low
2. H: High level, L: Low level

A.3.11 74LS373 (3-State D-latch)

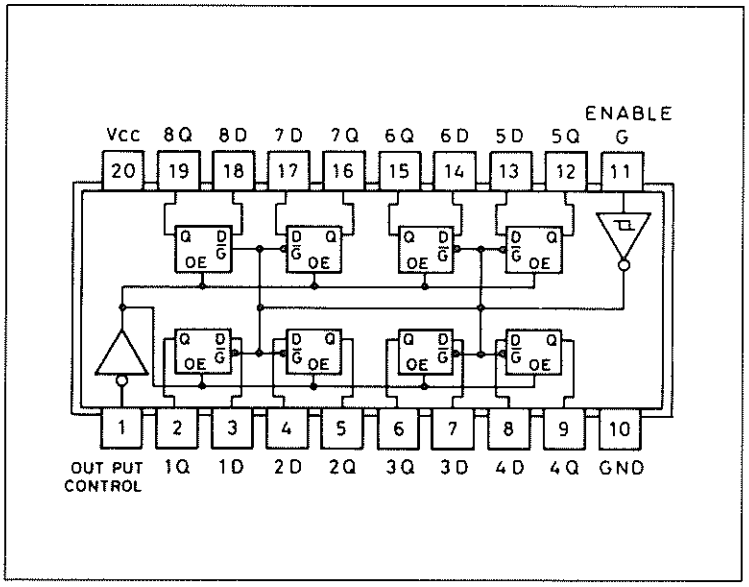


Fig. A-23. Pin Assignment (74LS373)

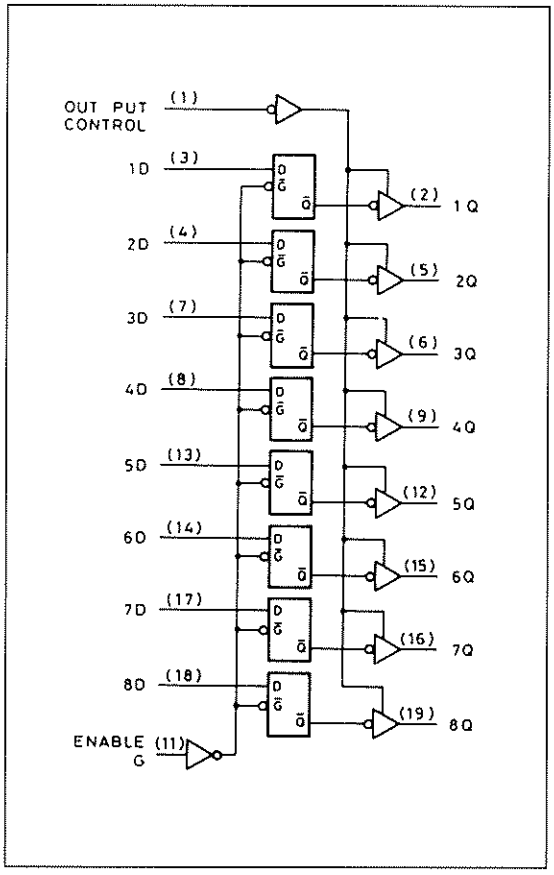


Fig. A-24. Equivalent Circuit (74LS373)

- When the output control is HIGH, 1Q to 8Q are high impedance.
- With G changed from HIGH to LOW, the data is latched.

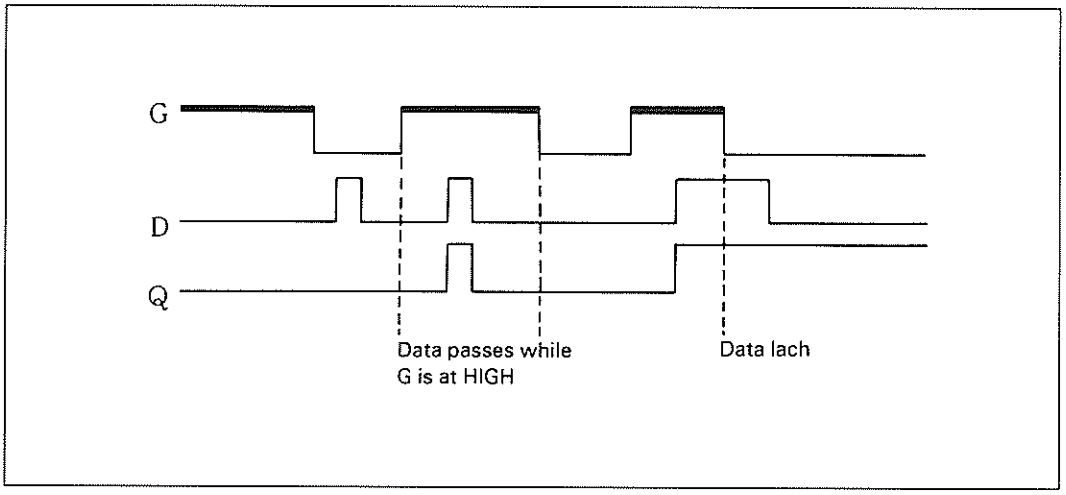


Fig. A-25. Data Latch Timing (74LS373)

A.3.12 74LS374 (Octal D-Type Edge-Trigger F/F)

74LS374 has eight D-type edge-trigger flip-flops (3-state output) in a 20-pin package.
The input state is latched at the leading edge of the clock pulse. According to the data latched, the Q output is at High or Low level or high impedance. With the Q output at high impdedance, no bus lines are affected.

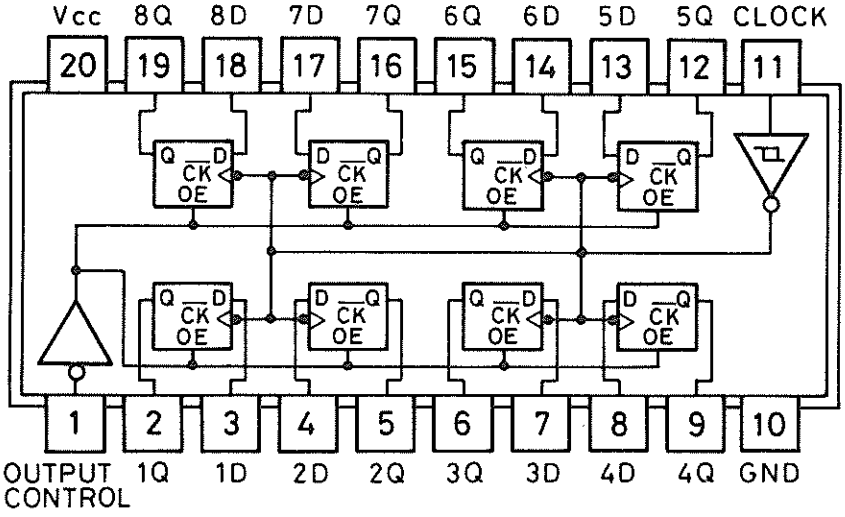
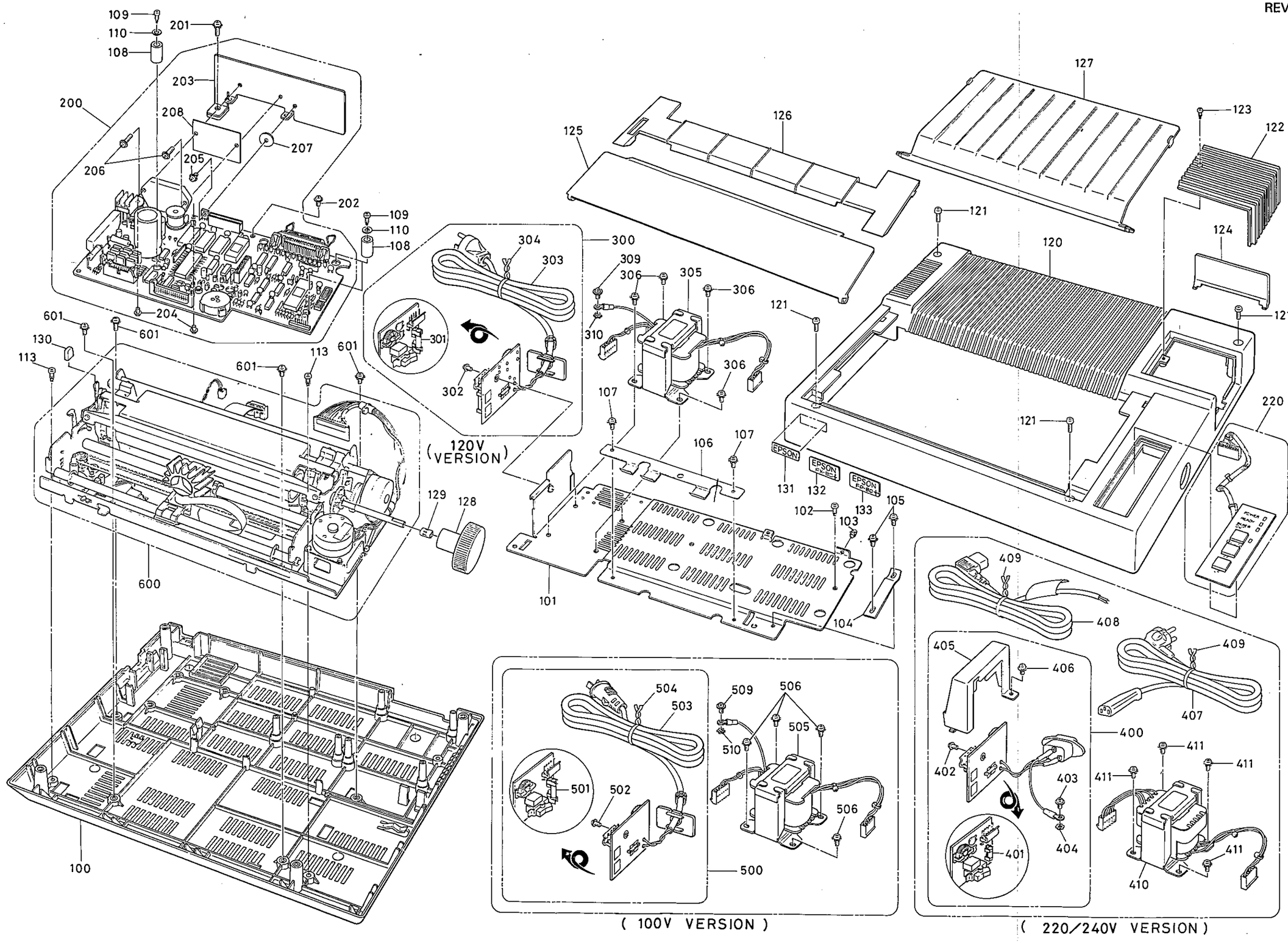


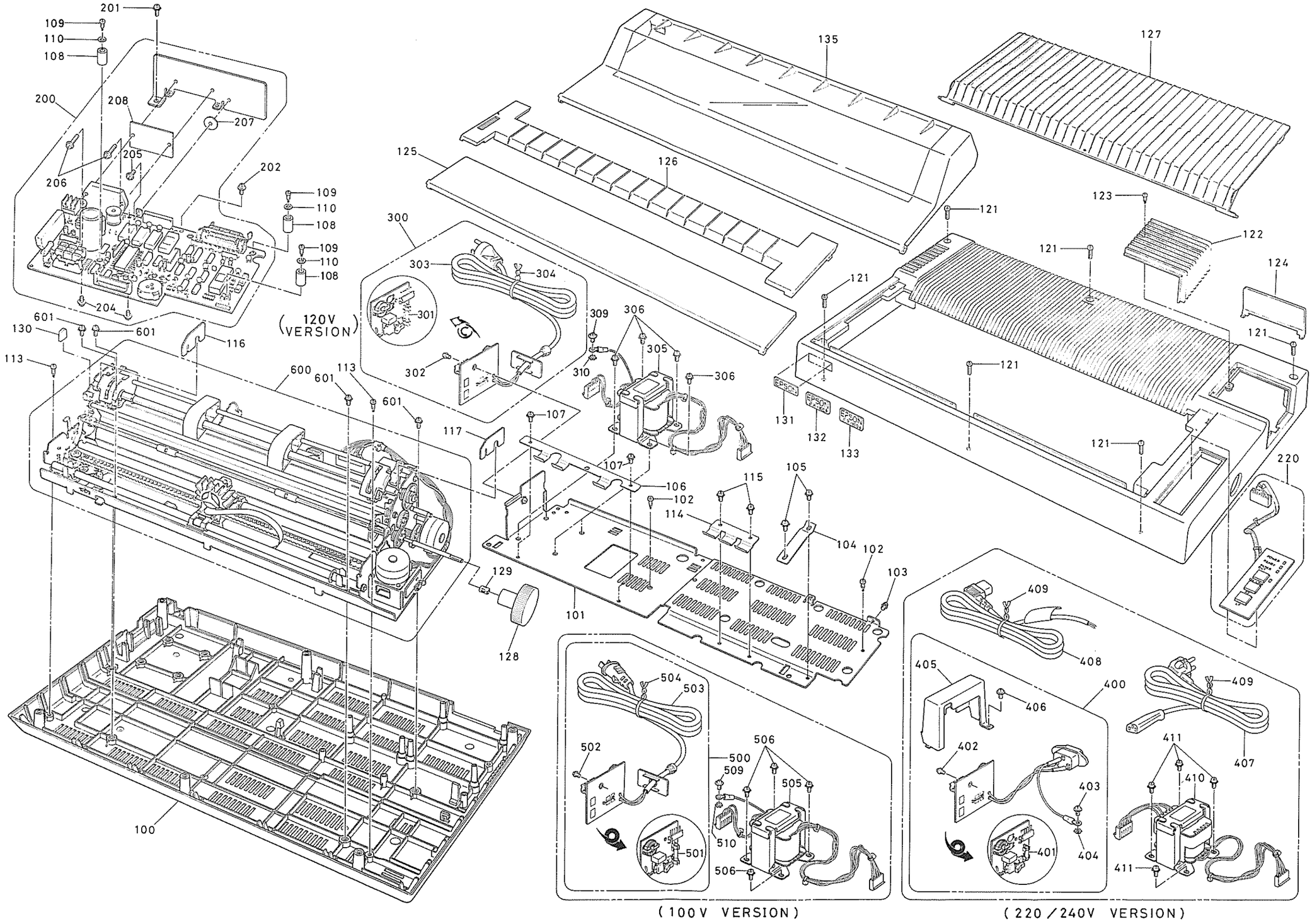
Fig. A-26. Pin Assignment (74LS374)

Table A-10. Truth Table (74LS374)

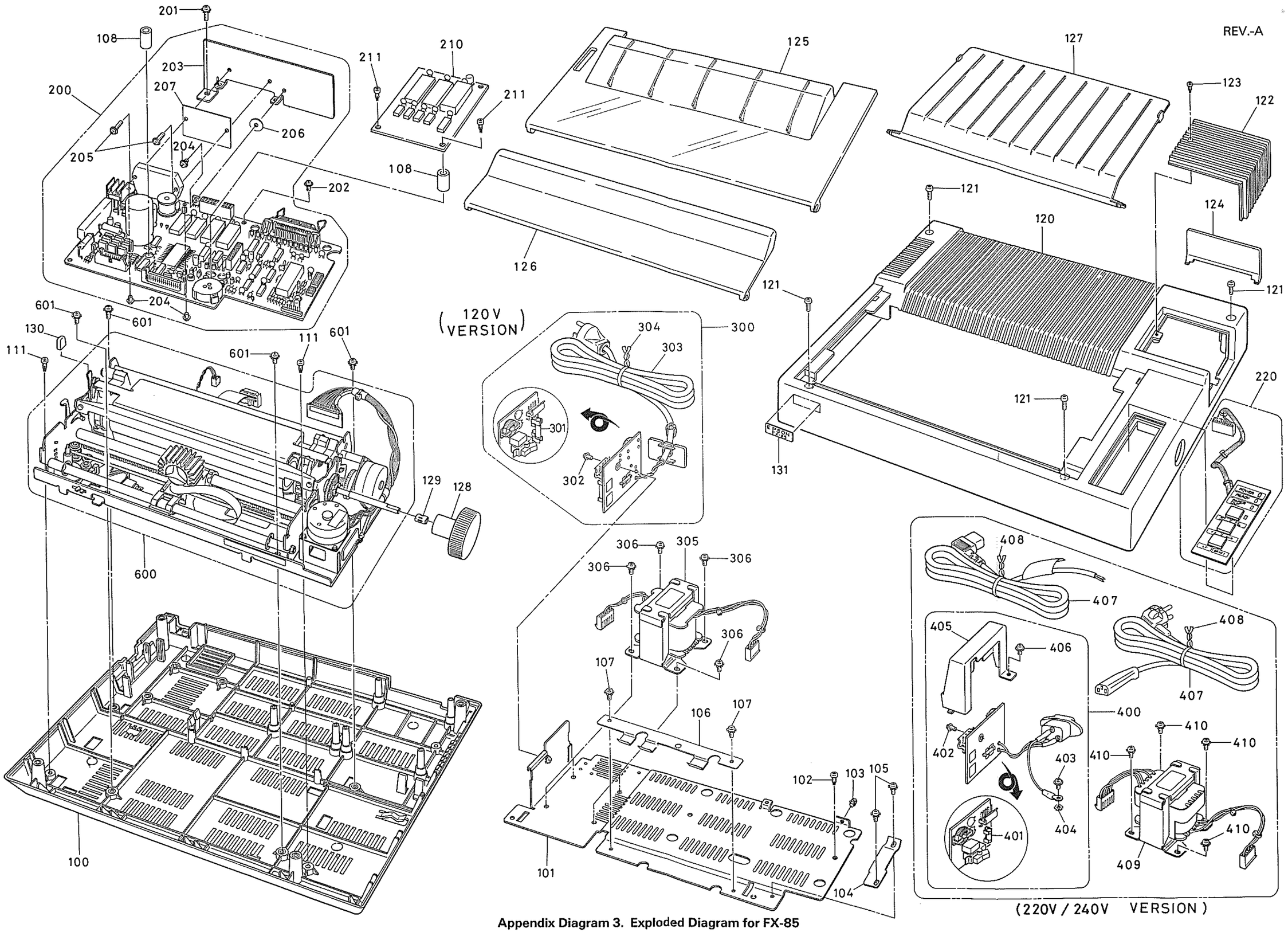
OUTPUT CONTROL	CLOCK	D	OUTPUT
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z



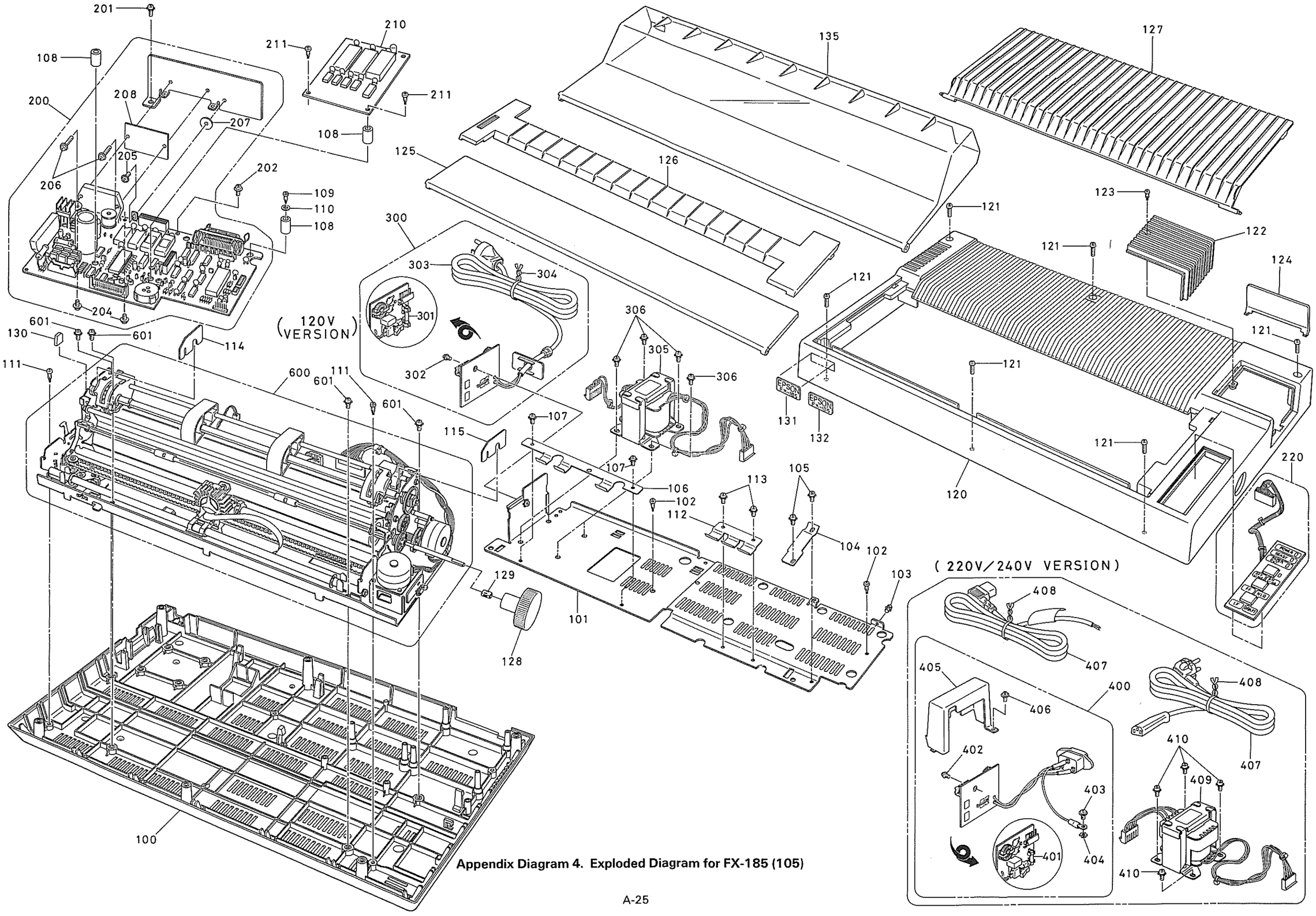
Appendix Diagram 1. Exploded Diagram for FX-80+



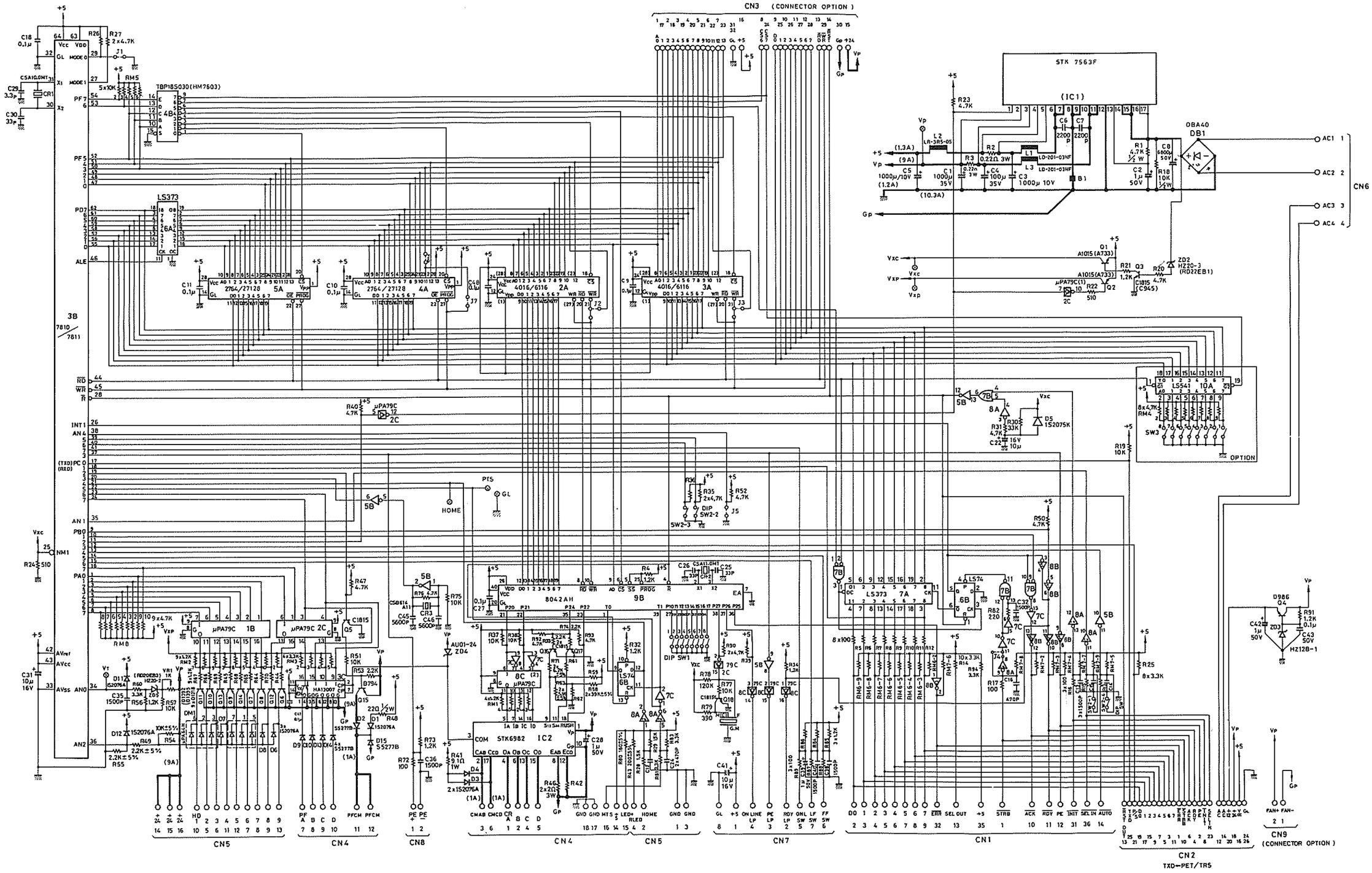
Appendix Diagram 2. Exploded Diagram for FX-100+



Appendix Diagram 3. Exploded Diagram for FX-85

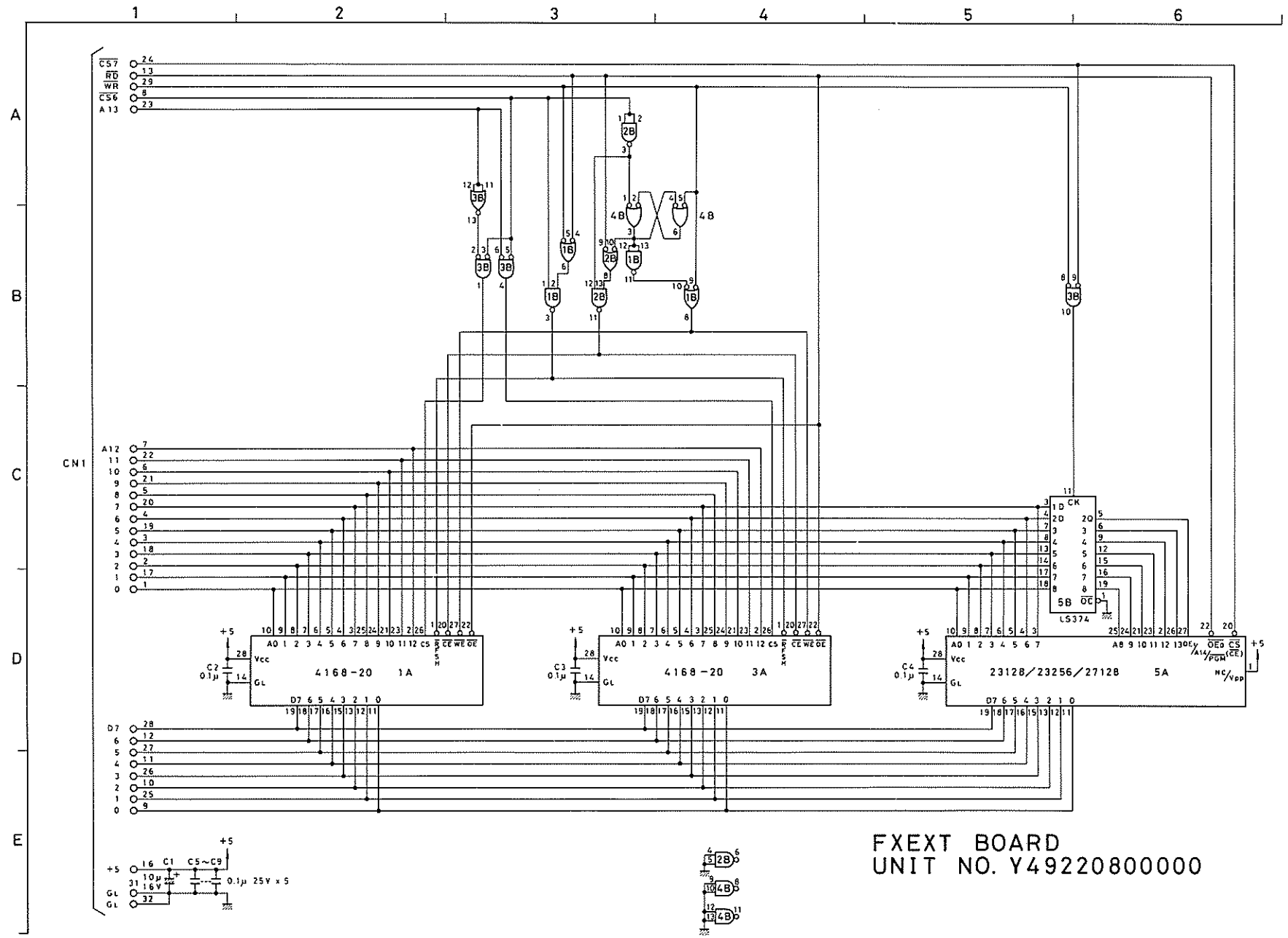


Appendix Diagram 4. Exploded Diagram for FX-185 (105)

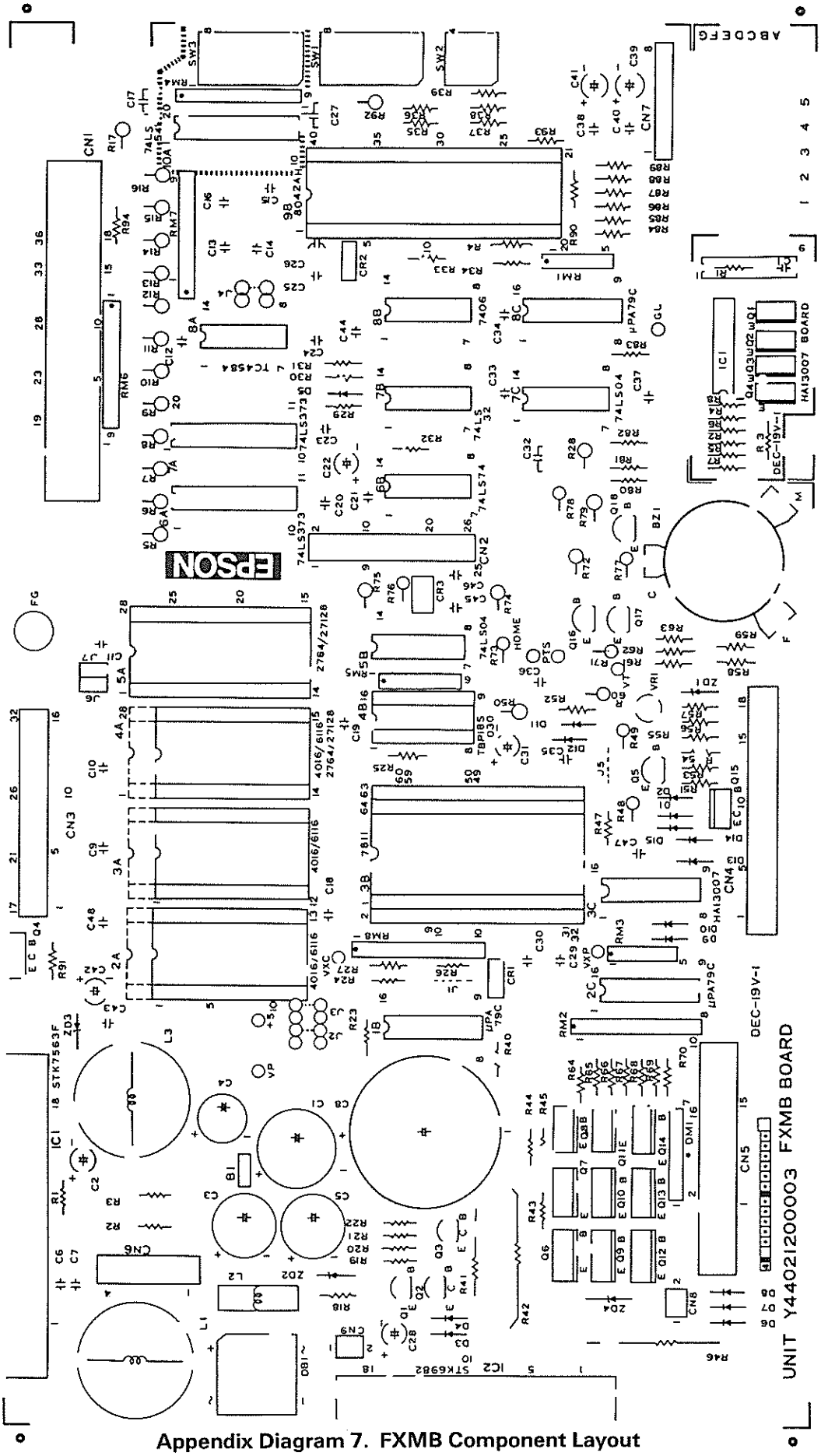


Appendix Diagram 5. FXMB Circuit Diagram

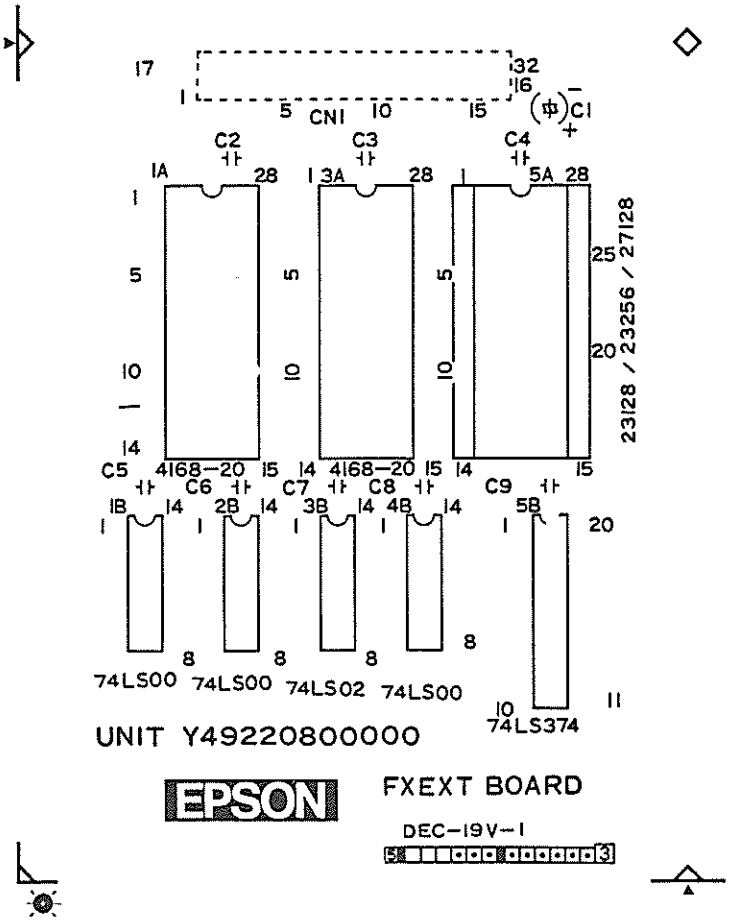
Appendix Diagram 6. FXEXT Circuit Diagram



REV.-A



Appendix Diagram 7. FXMB Component Layout



Appendix Diagram 8. FXEXT Component Layout

EPSON

SEIKO EPSON CORPORATION
BUSINESS & INDUSTRIAL INSTRUMENT DIVISION

EPSON OVERSEAS MARKETING LOCATIONS

EPSON AMERICA, INC.
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